Project No. ASF06-456-35
January 18, 2017

Raba Kistner
Environmental, Inc.
12821 W. Golden Lane
San Antonio, TX 78249

P.O. Box 690287
San Antonio, TX 78269-0287

www.rkci.com

P 210 :: 699 :: 9090
F 210 :: 699 :: 6426
TBPE Firm F-3257

Ms. Guanhua Gai
Project Manager
MSW Permits Section, Mail Code 124
Waste Permits Division
Texas Commission on Environmental Quality
12100 Park 35 Circle, Building F
Austin, Texas 78753

RE: Revised Application for Permit Modification
Methane Gas Remediation Plan and Landfill Gas Management Plan
Closed City of Tomball Landfill – Harris County
MSW Permit No. 1140A
RN102120755/CN600667190

Dear Ms. Gai:

On behalf of the City of Tomball, **Raba Kistner Environmental, Inc. (RKEI)** is pleased to provide the Texas Commission on Environmental Quality (TCEQ) Municipal Solid Waste (MSW) Waste Permits Section the attached methane gas remediation plan in the form of a revised application for modification of Municipal Solid Waste (MSW) Permit No. 1140A for the closed City of Tomball Landfill in accordance with *Title 30 of the Texas Administrative Code (30 TAC), Rule (§) 305.70(k)(3)*. Pursuant to TCEQ MSW Permits Section request in correspondence dated September 17, 2015, the City of Tomball (CoT) is also requesting a modification to MSW Permit No. 1140A to hereafter include a Landfill Gas Management Plan, which was developed in accordance with *30 TAC §330.371* requirements and is additionally provided as part of this permit modification application submittal. Submittal of this information is in the referenced formats as directed in TCEQ correspondence dated January 21, 2016 and follows from **RKEI's** and the CoT's meeting with the former TCEQ project manager for this facility, Mr. Pladej "Hunt" Prompuntagorn on February 10, 2016.

RKEI on behalf of the CoT recently initiated implementation of a methane gas remediation plan with the objective of addressing methane gas detections in excess of 5 percent (%) volume in air periodic methane exceedences at three perimeter detection points of compliance (POCs); specifically landfill gas detection probes (LGDPs) LGDP-3, LGDP-4 and LGDP-6. The following paragraphs provide a brief synopsis of pertinent background information in addition to directives provided by the TCEQ pertaining to this regulatory submittal package.

BACKGROUND

Following establishment of the perimeter landfill gas (LFG) monitoring network in April 2013, monthly perimeter landfill gas (LFG) monitoring activities have been conducted since the fourth quarter of 2013 up to the present utilizing seven LGDPs in response to perimeter methane detection monitoring results exceeding 5% volume in air measured at the FACILITY boundary. In accordance with TCEQ directives,

monitoring results have been reported to the TCEQ MSW Permits Section on a quarterly basis. Monthly perimeter LFG detection monitoring results for the second quarter of 2015 were reported in a quarterly monitoring report dated July 27, 2015, to which the TCEQ MSW Permits Section acknowledged receipt in correspondence dated September 17, 2015. In the September 17, 2015 correspondence, the TCEQ directed that, *"Based on the 2015 LFG monitoring results, additional remedial measures are required as soon as practicable along the northern and eastern facility boundary in accordance with 30 TAC §330.371(c). Please submit a remediation plan in accordance with 30 TAC §330.371(c) and the facility permit."*

In accordance with the TCEQ directive, an *Application for Permit Modification - Methane Gas Response Action Plan and Landfill Gas Management Plan*, was submitted by **RKEI** on behalf of the CoT to the TCEQ MSW Permits Section on November 19, 2015 to assess and address the reported methane gas exceedences at the facility permit boundary. Comments to the PMA submittal were provided in TCEQ correspondence entitled *Technical Notice of Deficiency – MSW Permit No. 1140A Permit Modification Application – Adding Landfill Gas Remediation and Management Plans*, dated January 21, 2016.

On February 10, 2016, **RKEI**, along with representatives for the CoT Department of Public Works attended a meeting with the TCEQ MSW Permits Section to discuss the technical notices of deficiency (NODs) noted in the referenced response letter and the path forward to address methane detections exceeding 5% volume in air at select perimeter LFG monitoring stations. The objectives of the meeting were met, in that a mutual understanding between the TCEQ and the CoT regarding the path forward was achieved. At the meeting, the TCEQ verbally encouraged employment of whatever activities are deemed appropriate in order to assess methane gas occurrence at the FACILITY permit boundary, in order to inform the remedial planning and implementation process.

RECENT TCEQ DIRECTIVES

On the basis of information provided by the TCEQ MSW Permits Section, **RKEI** understands that the former case manager for the facility, Mr. Hunt Prompuntagorn, with whom the referenced February 10, 2016 meeting took place, has retired. TCEQ MSW Permits Section case management of MSW Permit No. 1140A currently rests with Ms. Guanhua Gai and is overseen by Ms. Gulay Aki. **RKEI** was contacted via email by Ms. Gai on November 1 and 2, 2016, to inquire as to the methane gas remediation plan status. Subsequently, on November 15, 2016, **RKEI** participated in a telephone discussion with Ms. Gai and Ms. Aki regarding the status of the requested methane remediation plan. As an outcome of the discussion, and in an effort to streamline the process of addressing the January 21, 2016 PMA NODs, it was agreed that the following actions would be completed:

1. **RKEI**, on behalf of the CoT, will submit a description of any modifications to the facility enacted as part of implementation of the methane gas remediation plan in Section 9 of a Permit/Registration Modification and Temporary Authorization Application Form (TCEQ-20650).
2. An updated ¼-mile radius landowner map and list will be provided with the TCEQ-20650 Form.
3. A revised Landfill Gas Management Plan (LGMP), which is not yet considered officially part of MSW Permit No. 1140A, will be provided as an attachment to the TCEQ-20650 Form.

4. Pending TCEQ approval of the revised PMA, the CoT will provide notification by mail to landowners within a ¼-mile radius of the facility permit boundary, which will include the following elements:
    a. the name and address of the agency (the City of Tomball), and the telephone number of an agency contact from whom interested persons may obtain further information;
    b. the facility name and permit number as well as a brief background information section;
    c. reiteration of methane gas detections in excess of 5% volume in air at select perimeter LGDPs, along with a summary of monthly perimeter methane monitoring results; and
    d. a description of methane gas radiation plan implementation (i.e., soil vapor extraction vent installation).

RKEI has prepared a draft of the notification letter for CoT consideration, and pending amendment by incorporation of TCEQ comment, if provided, the City will so notify by mail the adjacent landowners and applicable easement-holders listed on the updated list that is provided as ***Attachment 2*** of the revised PMA form. The CoT has also updated its official website (http://tomballtx.gov) to provide this information to the public.

CLOSING

On behalf of the City of Tomball (permittee), we appreciate your review and consideration of the attached submittal. Should you have any questions or require additional information in this matter, please do not hesitate to contact either of the undersigned. This submittal has been approved by Mr. David Esquivel, Director of Public Works for the City of Tomball, on behalf of the City of Tomball.

Very truly yours,

RABA KISTNER ENVIRONMENTAL, INC.

Paul M. Sak, P.G.
Environmental Geologist

Richard V. Klar, P.G.
Vice President

PMS/RVK/srw

Attachments
Application for Permit Modification
Updated ¼-mile Radius Landowner Map and List
Landfill Gas Management Plan

Copies Submitted: Above (1 Original, 1 Copy)
Mr. David Esquivel – City of Tomball (1 Original, 1 Copy)
Ms. Nicole Bealle – TCEQ, Region 12 (1 Copy)

Facility Name: Closed City of Tomball Landfill
Permittee/Registrant Name: City of Tomball
MSW Authorization #: 1140A
Initial Submittal Date: 11/19/2015
Revision Date: 01/21/2017

Texas Commission on Environmental Quality

Permit/Registration Modification and Temporary Authorization Application Form for an MSW Facility

1. Reason for Submittal

☐ Initial Submittal ☒ Notice of Deficiency (NOD) Response

2. Authorization Type

☒ Permit ☐ Registration

3. Application Type

☒ Modification with Public Notice ☐ Modification without Public Notice

☐ Temporary Authorization (TA) ☐ Modification for Name Change/Transfer

4. Application Fees

☒ Pay by Check ☐ Online Payment

If paid online, e-Pay Confirmation Number:

5. Application URL

Is the application submitted for a permit/registration modification with public notice?

☒ Yes ☐ No

If the answer is "Yes", enter the URL address of a publicly accessible internet web site where the application and all revisions to that application will be posted in the space provided: **http://tomballtx.gov - under the "news and headlines" tab.**

6. Confidential Documents

Does the application contain confidential documents?

☐ Yes ☒ No

If "Yes", cross-reference the confidential documents throughout the application and submit as a separate attachment in a binder clearly marked "CONFIDENTIAL."

7. General Facility Information

Facility Name: **Closed City of Tomball Landfill**

MSW Authorization No.: **1140A**

Regulated Entity Reference No.: **102120755**

Physical or Street Address (if available): **Southern Terminus of Neal Drive**

City: **Tomball** County: **Harris** State: **Texas** Zip Code: **77375**

(Area code) Telephone Number: **(281) 290-1400**

Latitude: **30° 06′ 41.36″ N** Longitude: **95° 36′ 36.81″ W**

8. Facility Type(s)

☒ Type I	☐ Type IV	☐ Type V
☐ Type I AE	☐ Type IV AE	☐ Type VI

9. Description of the Revisions to the Facility

Provide a brief description of all revisions to the permit/registration conditions and supporting documents referred by the permit/registration, and a reference to the specific provisions under which the modification/temporary authorization application is being made. Also, provide an explanation of why the modification/temporary authorization is requested:

Explanation of Request

The modification MSW Permit No. 1140A (i.e., placement of a methane gas remediation plan in the operating record for the closed City of Tomball landfill) is requested to address methane gas detections in excess of 5 percent (%) volume in air at select perimeter landfill gas detection probes (LGDPs) installed along the facility permit boundary. The methane gas remediation plan was implemented during the fourth quarter of 2016 in order to maintain compliance with *Title 30 of the Texas Administrative Code (30 TAC), Part 1, Chapter 330, Subchapter I, Rule* (*§*)330.371(a)(2) and *(§)330.371(c)(3)*.

Background

On June 29, 30 and July 1, 2016, a bar probe survey was conducted to assess the elevated perimeter methane levels to determine "*the nature and extent of the problem and a proposed remedy*" pursuant to *30 TAC §330.371 (c)(3)*. Fourteen soil borings (i.e., bar probe assessment sampling stations) were installed at the facility northern, northeastern and southeastern perimeters to depths of 25 feet below existing grade surface (bgs). Landfill gas concentrations were measured at 5-foot intervals utilizing soil vapor sampling procedures.

Downhole methane levels were detected at depths on the order of 20 to 25 feet below grade surface (bgs) in bar probe borings located proximal to LGDP-3, LGDP-4 and LGDP-6, coincident with a transition from silty and/or sandy clay strata to slightly clayey sand and/or poorly graded fine sand. As the sand stratum is more permeable than the overlying clay stratum to ground surface, this finding is consistent with fact that methane gas migration occurs by advection and diffusion (i.e., a pressure gradient) along the path of least resistance, with the sand stratum providing a "preferential pathway" for gas migration relative to the relatively impermeable overlying clay strata.

Implementation of Methane Gas Remediation Plan

In order to intercept methane gas presumably migrating from the facility waste disposal areas to the three perimeter probes currently out of compliance (i.e., LGDP-3, LGDP-4 and LGDP-6), and following from bar probe survey findings, on October 25 through 28, 2016, three batteries of four passive soil vapor extraction (SVE) vents were installed between facility waste cells B, C and I and LGDP-3, LGDP-4 and LGDP-6, respectively, totaling 12 SVE vent installations. The locations of the 12 SVE vents relative to waste cells B, C and I and probes LGDP-3, LGDP-4 and LGDP-6 are shown on the attached Figure 1.

Within each of the three batteries, the four passive SVE vents were constructed approximately 25 feet apart and screened over 10-foot depth intervals within a sand stratum observed to exhibit elevated methane levels during the bar probe survey, with the objective to provide an approximate 100^{+}-foot zone to vent the subsurface of methane gas prior to it reaching these LGDPs. The attached graphical boring logs and State of Texas Well Reports depict and describe encountered subsurface conditions and passive SVE vent construction details.

Attachments

In accordance with *30 TAC, §305.70(i)*, an updated ¼-mile radius landowner map and list is additionally provided as an attachment this TCEQ-20650 Form. Landowner notification will be provided upon TCEQ approval of the revised PMA.

As the closed City of Tomball Landfill operating record currently does not include the attached Landfill Gas Management Plan (LGMP), additional modification of MSW Permit No. 1140A is requested to incorporate the attached LGMP, which has been prepared in accordance with *30 TAC §330.371 (g)*.

10. Facility Contact Information

Site Operator (Permittee/Registrant) Name: City of Tomball

Customer Reference No. (if issued)*: **CN600667190**

Mailing Address: **401 Market Street, Suite C**

City: **Tomball** County: **Harris** State: **Texas** Zip Code: **77375**

(Area Code) Telephone Number: **(281) 290-1400**

Email Address: **desquivel@tomballtx.gov**

TX Secretary of State (SOS) Filing Number:

*If the Site Operator (Permittee/Registrant) does not have this number, complete a TCEQ Core Data Form (TCEQ-10400) and submit it with this application. List the Site Operator (Permittee/Registrant) as the Customer.

Operator Name[1]: ***"Same as "Site Operator (Permittee/Registrant)".***

Customer Reference No. (if issued)*:

Mailing Address:

City: County: State: Zip Code:

(Area Code) Telephone Number:

Email Address:

Charter Number:

[1]If the Operator is the same as Site Operator/Permittee type "Same as "Site Operator (Permittee/Registrant)".
*If the Operator does not have this number, complete a TCEQ Core Data Form (TCEQ-10400) and submit it with this application. List the Operator as the customer.

Consultant Name: Raba Kistner Environmental, Inc. (Attn. Mr. Richard Klar, P.G.)

Texas Board of Professional Engineers Firm Registration Number: **F-3257**

Mailing Address: **12821 W. Golden Lane**

City: **San Antonio** County: **Bexar** State: **Texas** Zip Code: **78249**

(Area Code) Telephone Number: **(210) 699-9090**

E-Mail Address: **rklar@rkci.com**

Agent in Service Name (required only for out-of-state):

Mailing Address:

City: County: State: Zip Code:

(Area Code) Telephone Number:

E-Mail Address:

11. Ownership Status of the Facility

Is this a modification that changes the legal description, the property owner, or the Site Operator (Permittee/Registrant)?

☐ Yes ☒ No

If the answer is "No", skip this section.

Does the Site Operator (Permittee/Registrant) own all the facility units and all the facility property?

☐ Yes ☐ No

If "No", provide the information requested below for any additional ownership.

Owner Name:

Street or P.O. Box:

City: County: State: Zip Code:

(Area Code) Telephone Number:

Email Address (optional):

Charter Number:

Signature Page

I, _____, _____,
(Site Operator (Permittee/Registrant)'s Authorized Signatory) (Title)

certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature: _____ Date: _____

TO BE COMPLETED BY THE OPERATOR IF THE APPLICATION IS SIGNED BY AN AUTHORIZED REPRESENTATIVE FOR THE OPERATOR

I, City of Tomball, hereby designate Mr. David Esquivel
(Print or Type Operator Name) (Print or Type Representative Name)

as my representative and hereby authorize said representative to sign any application, submit additional information as may be requested by the Commission; and/or appear for me at any hearing or before the Texas Commission on Environmental Quality in conjunction with this request for a Texas Water Code or Texas Solid Waste Disposal Act permit. I further understand that I am responsible for the contents of this application, for oral statements given by my authorized representative in support of the application, and for compliance with the terms and conditions of any permit which might be issued based upon this application.

Gretchen Fagan (Mayor - City of Tomball, Texas)
Printed or Typed Name of Operator or Principal Executive Officer

_____
Signature

SUBSCRIBED AND SWORN to before me by the said Gretchen Fagan

On this 18 day of January, 2017

My commission expires on the 19 day of April, 2018

_____
Notary Public in and for

Harris County, Texas
(Note: Application Must Bear Signature & Seal of Notary Public)

MEAGAN MAGEO
Notary Public, State of Texas
My Commission Expires 04-19-2018
Notary ID # 12824497-0

Signature Page

I, Mr. David Esquivel, Director of Public Works, City of Tomball, TX, (Site Operator (Permittee/Registrant)'s Authorized Signatory) certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature: David Esquivel Date: 01/18/17

TO BE COMPLETED BY THE OPERATOR IF THE APPLICATION IS SIGNED BY AN AUTHORIZED REPRESENTATIVE FOR THE OPERATOR

I, City of Tomball, Texas, hereby designate Mr. David Esquivel as my representative and hereby authorize said representative to sign any application, submit additional information as may be requested by the Commission; and/or appear for me at any hearing or before the Texas Commission on Environmental Quality in conjunction with this request for a Texas Water Code or Texas Solid Waste Disposal Act permit. I further understand that I am responsible for the contents of this application, for oral statements given by my authorized representative in support of the application, and for compliance with the terms and conditions of any permit which might be issued based upon this application.

Gretchen Fagan (mayor – City of Tomball, Texas)
Printed or Typed Name of Operator or Principal Executive Officer

_____
Signature

SUBSCRIBED AND SWORN to before me by the said Mr. David Esquivel

On this 18 day of January, 2017

My commission expires on the 19 day of April, 2018

_____
Notary Public in and for

Harris County, Texas
(Note: Application Must Bear Signature & Seal of Notary Public)

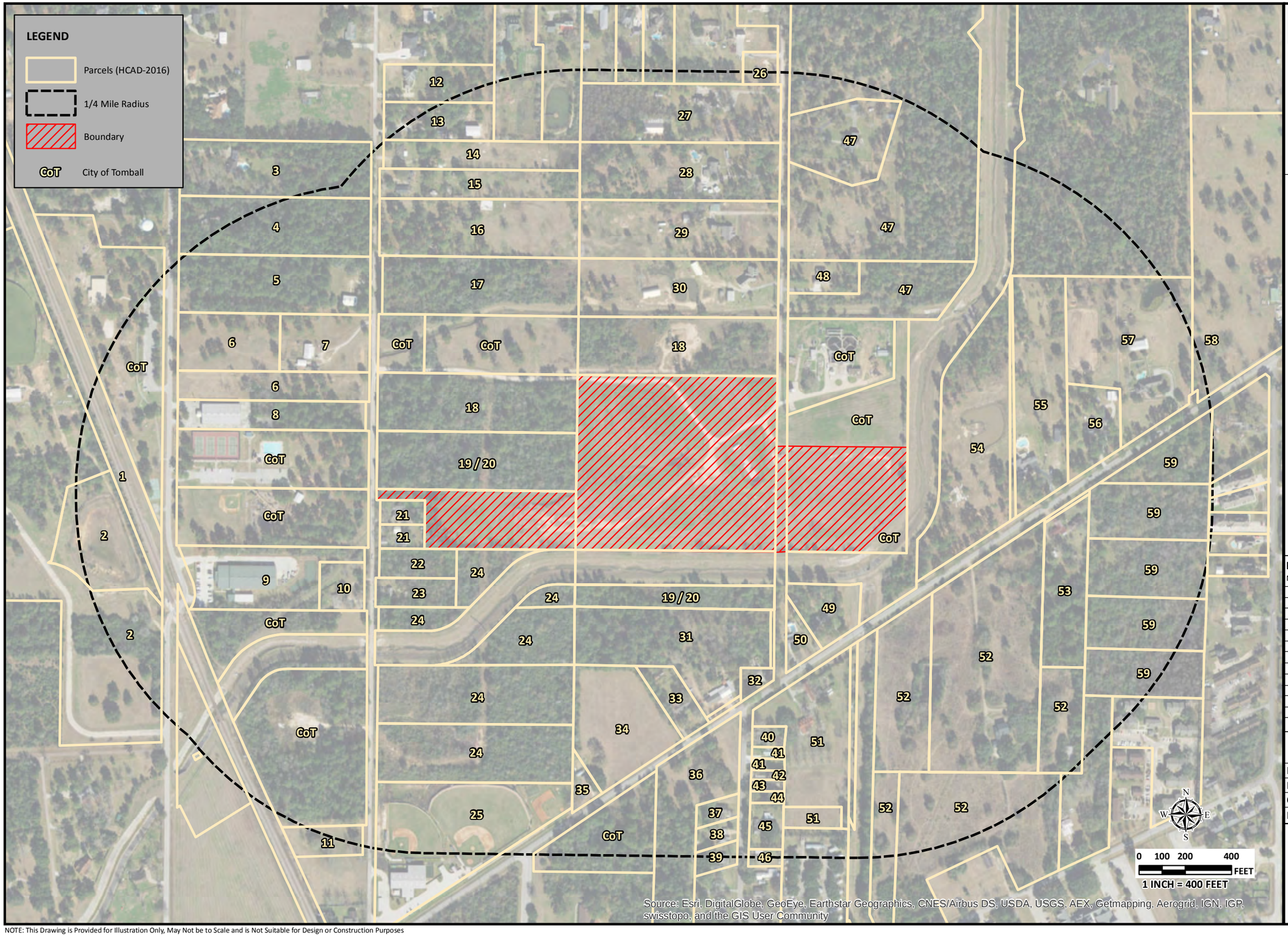
Permit/Registration Modification with Public Notice

(See Instructions for P.E. seal requirements.)

Required Attachments	**Attachment No.**
Land Ownership Map	**1**
Land Ownership List	**2**
Marked (Redline/Strikeout) Pages	**Not Applicable**
Unmarked Revised Pages	**Not Applicable**

Additional Attachments as Applicable- Select all those apply and add as necessary

☐ Signatory Authority	
☐ Fee Payment Receipt	
☐ Confidential Documents	
☒ Figure 1 – Soil Vapor Eextraction Vent Location Map	**3**
☒ Landfill Gas Management Plan	**4**



NOTE: This Drawing is Provided for Illustration Only, May Not be to Scale and is Not Suitable for Design or Construction Purposes

RABA KISTNER ENVIRONMENTAL
Raba Kistner Environmental, Inc.
12821 West Golden Lane
San Antonio, Texas 78249
www.rkci.com
P 210 :: 699 :: 9090
F 210 :: 699 :: 6426
TBPE Firm F-3257 / TBPG Firm #50220

ADJACENT PROPERTIES WITHIN 1/4 MILE

CLOSED CITY OF TOMBALL LANDFILL
HARRIS COUNTY
MSW PERMIT No. 1140A
RN102120755/CN600667190

REVISIONS:

No.	DATE	DESCRIPTION

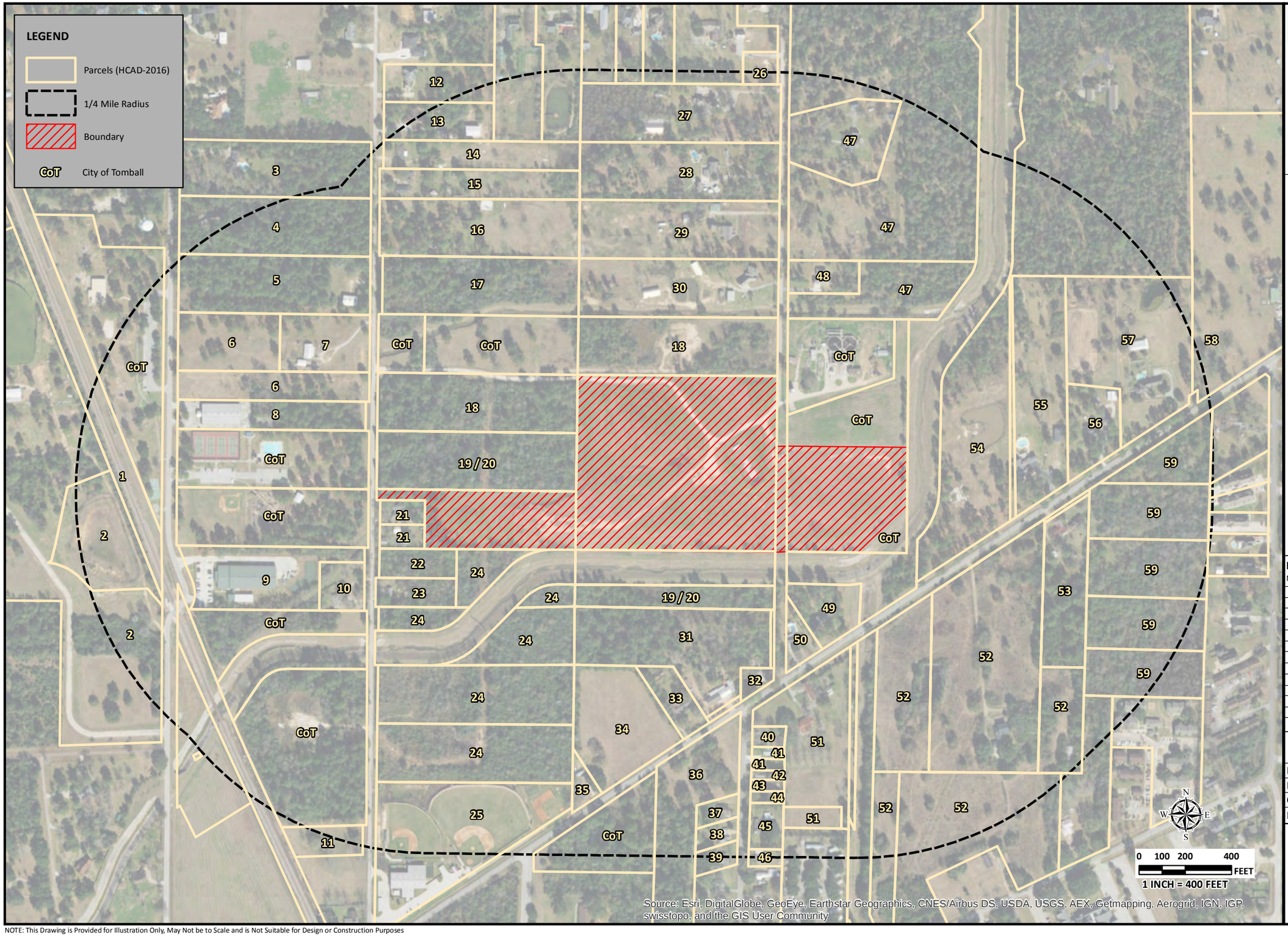
PROJECT No.:	ASF06-456-35
ISSUE DATE:	01-18-17
DRAWN BY:	LAW
CHECKED BY:	PMS
REVIEWED BY:	RVK

ATTACHMENT

A.1

ATTACHMENT 1

UPDATED ¼-MILE RADIUS LANDOWNERS MAP



NOTE: This Drawing is Provided for Illustration Only, May Not be to Scale and is Not Suitable for Design or Construction Purposes

RABA KISTNER ENVIRONMENTAL
Raba Kistner Environmental, Inc.
12821 West Golden Lane
San Antonio, Texas 78249
www.rkci.com
P 210 :: 699 :: 9090
F 210 :: 699 :: 6426
TBPE Firm F-3257 / TBPG Firm #50220

ADJACENT PROPERTIES WITHIN 1/4 MILE

CLOSED CITY OF TOMBALL LANDFILL
HARRIS COUNTY
MSW PERMIT No. 1140A
RN102120755/CN600667190

REVISIONS:

No.	DATE	DESCRIPTION

PROJECT No.:	ASF06-456-35
ISSUE DATE:	01-18-17
DRAWN BY:	LAW
CHECKED BY:	PMS
REVIEWED BY:	RVK

ATTACHMENT

A.1

ATTACHMENT 2

UPDATED ¼-MILE RADIUS LANDOWNERS LIST

LANDOWNERS CROSS-REFERENCED TO LANDOWNERS MAP

1 BURLINGTON NORTHERN RR
PO BOX 961089
FORT WORTH, TX 76161-0089

2 TOMBALL ISD
221 W MAIN STREET
TOMBALL, TX 77375-5529

3 GARY & RAYE L BREAUX
1412 ULRICH RD
TOMBALL, TX 77375-4320

4 NCWPCS MPL 27 YEAR SITES TOWER HOLDING
575 MOROSGO DR NE, STE 13
ATLANTA,GA 30324-3300

5 RICHARD T BREAUX
1311 RUDOLPH RD
TOMBALL, TX 77375-4395

6 KEVIN SNYDER & LARRY SNYDER
7807 BYRON CT
SPRING, TX 77379-3173

7 LARRY G SNYDER
1245 RUDOLPH RD
TOMBALL, TX 77375-4381

8 NANCY GOMEZ REVOCABLE LIVING TRUST
1230 ULRICH RD
TOMBALL, TX 77375-4324

9 EAGLE GASKET & PACKING CO
1110 ULRICH RD
TOMBALL, TX 77375-4326

10 JOSEPH MENDEZ & ELENA CHAVEZ
1019 RUDOLPH RD
TOMBALL, TX 77375-4330

11 LEE J CUMMINGS & ELIZABETH J BONDS
PO BOX 252
TOMBALL, TX 77377-0252

12 DONALD W & DONNA GARRETT
1510 RUDOLPH RD
TOMBALL, TX 77375-4378

13 N T & DOROTHY BREAUX
1502 RUDOLPH RD
TOMBALL, TX 77375-4378

14 BREAUX PROPERTIES LTD
1502 RUDOLPH RD
TOMBALL, TX 77375-4378

15 RUBEN DELEON
1450 RUDOLPH RD
TOMBALL, TX 77375-4329

16 R G DONLEY
1442 RUDOLPH RD
TOMBALL, TX 77375-4329

17 KEITH & ILEANA MATHENIA
2036 COMFORT
CANYON LAKE, TX 78133-4006

18 AMERICO OIL & GAS PROPERTIES
7575 SAN FELIPE ST, STE 200
HOUSTON, TX 77063-1778

19 ANITA ANDERSON C/O F G MOORE
14999 WUNDERLICH DR, UNIT 110
HOUSTON, TX 77069-2048

20 TANDEM ENERGY CORPORATION
2700 POST OAK BLVD, STE 1000
HOUSTON, TX 77056-5778

21 SHERRY JOHNSONLEWANDOWSKI
PO BOX 49
TOMBALL, TX 77377-0049

22 RICARDO A & MARIA CANAS
6830 FALLING WATERS DR
SPRING, TX 77379-4804

23 BOBBY GRANGER LD704 LYNWOOD TRUST
30211 HIGHLAND BLVD
MAGNOLIA, TX 77354-6160

24 PRESARIO PROPERTIES LLC
2559 BEECHWOOD VILLAGE CT
HENDERSON, NV 89052-7139

LANDOWNERS CROSS-REFERENCED TO LANDOWNERS MAP

25 HIGH HEATER LLC
201 E HUFSMITH RD
TOMBALL, TX 77375-4350

26 MITCHELL P CAPPADONNA & JEFFIE CAPPADOI
12727 ZION RD
TOMBALL, TX 77375-3034

27 STANLEY & PATTY ZWERNEMAN
1515 NEAL DR
TOMBALL, TX 77375-4306

28 MICHAEL D WILSON
1423 NEAL DR
TOMBALL, TX 77375-4311

29 CASEY A LIPP
1345 NEAL DR
TOMBALL, TX 77375-4380

30 DAVID A & CHERYL L JANKE
1335 NEAL DR
TOMBALL, TX 77375-4380

31 ABANDONED ANIMAL RESCUE
419 E HUFSMITH RD
TOMBALL, TX 77375-4342

32 HELEN LOUISE OWENS, ESTATE OF PIERCE OWI
503 E HUFSMITH RD
TOMBALL, TX 77375-4840

33 DANA WADE
413 E HUFSMITH RD
TOMBALL, TX 77375-4342

34 TENNIS VENTURE LIMITED LIABILITY COMPANY
43 GOLDEN ORCHARD PL
MAGNOLIA, TX 77354-3353

35 GUSSIE ASHLEY RUDEL
327 E HUFSMITH RD
TOMBALL, TX 77375-4340

36 QUEST IRA INC
17171 PARK ROW STE 100
HOUSTON, TX 77084-4935

37 SHAVER TIM & SANDRA
622 HOSPITAL ST
TOMBALL, TX 77375-4829

38 ROBIN J DAVIDSON & KEVIN R PARKER
612 HOSPITAL ST
TOMBALL, TX 77375-4829

39 MAUDIE LEE HASLEY / SYLETA JONES
610 HOSPITAL ST
TOMBALL, TX 77375-4829

40 SALLIE CLINTON FISHER
723 HOSPITAL ST
TOMBALL, TX 77375-4830

41 JOSH BURNS TRUSTEE & ZAC
12530 ZION RD
TOMBALL, TX 77375-3020

42 MICHAEL BURNS & RENE BURNS
22739 TOMBALL CEMETERY RD
TOMBALL, TX 77377-3733

43 RHONDEE M DAMON
644 HOSPITAL ST
TOMBALL, TX 77375-4829

44 INDIGO HILLS INVESTMENTS GP LLC AI
14090 FM 2920 RD, STE G-329
TOMBALL, TX 77377-5549

45 BLAS & MARIA P ALFARO
7902 FORTROSE CT
HOUSTON, TX 77070-4342

46 ALLEN RUDY ALBERTH, JR
29118 DEER CREEK
MAGNOLIA, TX 77355-6528

47 THOMAS & JANICE CROFOOT
1430 NEAL DR
TOMBALL, TX 77375-4311

48 KEVEN & LISA R CROFOOT
1330 NEAL DR
TOMBALL, TX 77375-4380

LANDOWNERS CROSS-REFERENCED TO LANDOWNERS MAP

49 DEAN & LAURA POPIEL
511 E HUFSMITH RD
TOMBALL, TX 77375-4840

50 JAMES K BABB
507 E HUFSMITH RD
TOMBALL, TX 77375-4840

51 AMADEO JR & MARINELA VALADEZ
510 E HUFSMITH RD
TOMBALL, TX 77375-4841

52 JAYANTI K PATEL
6021 CALHOUN RD
HOUSTON, TX 77021-3305

53 FRANK H METZLER
802 E HUFSMITH RD
TOMBALL, TX 77375-4847

54 DEBORAH CARABALLO & RAFAEL F DIAZ
7502 DAYHILL DR
SPRING, TX 77379-8293

55 MICHAEL L & REBECCA M CLARK
519 E HUFSMITH RD
TOMBALL, TX 77375-4840

56 ARCHIE F & DORIS MAYWALD
523 E HUFSMITH RD
TOMBALL, TX 77375-4840

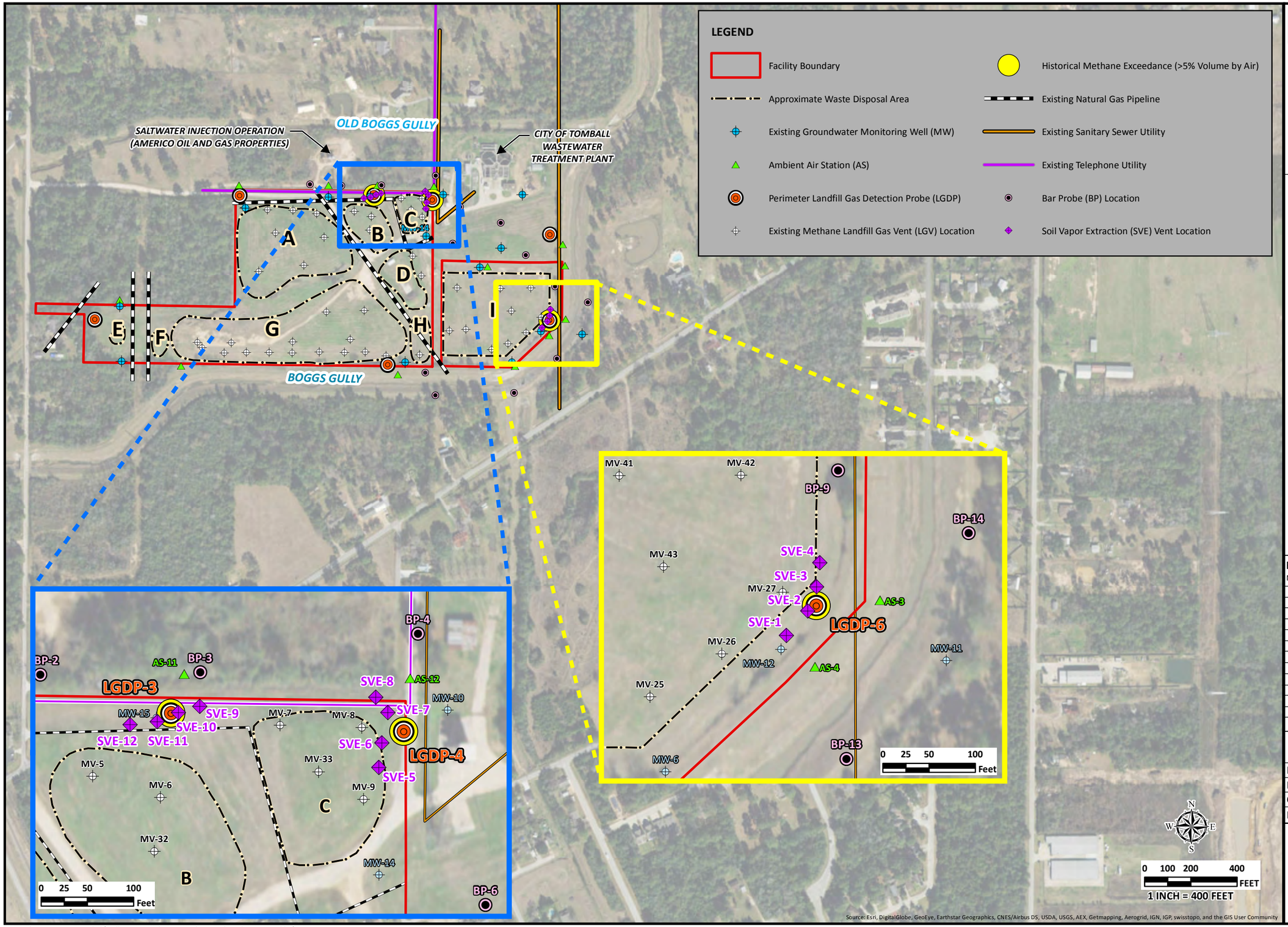
57 JAMES D & MARILYN DUNAGIN
535 E HUFSMITH RD
TOMBALL, TX 77375-4840

58 RODANO DANIEL G
12125 ZION RD
TOMBALL, TX 77375-3011

59 DAVID NOEL SMITH
6801 LINKWAY ST
SAN ANTONIO, TX 78240-3048

ATTACHMENT 3

SOIL VAPOR EXTRACTION VENT LOCATION MAP



RABA KISTNER ENVIRONMENTAL
Raba Kistner Environmental, Inc.
12821 West Golden Lane
San Antonio, Texas 78249
www.rkci.com
P 210 :: 699 :: 9090
F 210 :: 699 :: 6426
TBPE Firm F-3257 / TBPG Firm #50220

SVE VENT LOCATION MAP

CLOSED CITY OF TOMBALL LANDFILL
HARRIS COUNTY
MSW PERMIT No. 1140A
RN102120755/CN600667190

REVISIONS:

No.	DATE	DESCRIPTION

PROJECT No.:	ASF06-456-35
ISSUE DATE:	01-18-17
DRAWN BY:	LAW
CHECKED BY:	PMS
REVIEWED BY:	RVK

FIGURE

1

NOTE: This Drawing is Provided for Illustration Only, May Not be to Scale and is Not Suitable for Design or Construction Purposes

ATTACHMENT 4

LANDFILL GAS MANAGEMENT PLAN

CLOSED CITY OF TOMBALL LANDFILL
MUNICIPAL SOLID WASTE (MSW) – PERMIT NO. 1140A
RN102120755 / CN600667190
HARRIS COUNTY, TEXAS

LANDFILL GAS MANAGEMENT PLAN

Prepared for

CITY OF TOMBALL
Harris County, Texas

Prepared by

RABA KISTNER ENVIRONMENTAL, INC.
San Antonio, Texas

1/18/17

RKEI PROJECT NO. ASF06-456-35

January 2017

TABLE OF CONTENTS

FIGURES

ATTACHMENTS

1.0 INTRODUCTION §330.371 (A)

1.1 Purpose

This landfill gas management plan (LGMP) has been prepared for the closed City of Tomball (CoT) Landfill located east of Rudolph Road and north of East Huffsmith Road, within the City of Tomball in Harris County, Texas (hereinafter referred to as FACILITY) in accordance with *Title 30 of the Texas Administrative Code (30 TAC), Part 1, Chapter 330, Subchapter I, Rule (§) 330.371(g)*. This LGMP has been developed to protect lives and property from the hazards associated with landfill gas (LFG) by providing guidance for LFG (primarily methane) management and monitoring. Compliance with regulations set forth in *30 TAC § 330.371* requires owners/operators of all landfill units to implement a routine (i.e., quarterly or more frequently, as warranted) LFG monitoring program to verify that (i) methane concentrations do not exceed 1.25 percent (%) by volume in air within enclosed structures, and that (ii) methane concentrations do not exceed 5% by volume in air at monitoring points located at the landfill permit boundary.

1.2 Scope

The LGMP (i) describes the existing FACILITY LFG management and control system; (ii) describes the perimeter LFG detection monitoring network and the implementation of quarterly/monthly FACILITY perimeter and enclosed structure LFG monitoring; (iii) describes routine LFG monitoring procedures and verification of LFG monitoring results; and (iv) presents notification requirements and possible remedial scenarios, if warranted. This LGMP also describes the soil, hydrogeological and hydraulic conditions beneath and in the vicinity of the FACILITY based on a review of published geologic and groundwater information and boring logs created in conjunction with past phases of site characterization and assessment, as well as landfill gas vent (LGV), groundwater monitoring well (GWMW), perimeter landfill gas detection probe (LGDP), and passive soil vapor extraction (SVE) vent installations.

2.0 BACKGROUND

The FACILITY consists of nine discrete waste disposal areas designated A through I which received municipal solid waste (MSW) from 1979 until June 1993 and were closed in October 1994. A closure certificate effective October 1995 was approved by the Texas Natural Resources Conservation Commission on October 17, 1997. During and beyond the FACILITY post-closure monitoring period, which was initially targeted for completion in 2000, select chlorinated volatile organic compounds (VOCs) have been intermittently detected in groundwater at concentrations exceeding U.S. Environmental Protection Agency (EPA) primary maximum contaminant level (MCL) drinking water standards. As a result of these VOC detections, post-closure semi-annual groundwater monitoring has been continued to the present day.

LFG is managed and controlled at the FACILITY by the utilization of LGVs installed within and/or adjacent to seven of the nine FACILITY waste disposal areas, as well as 12 passive SVE vents installed at targeted locations along the FACILITY north, northeast and southeast perimeters. The current FACILITY permit boundaries, waste disposal areas, landfill gas (i.e., LGV and SVE) vents, and perimeter groundwater monitoring well and landfill gas detection probe networks are shown on ***Figure 1 – Site Plan***.

Throughout the FACILITY post-closure monitoring period prior to 2013, LFG was monitored quarterly at the FACILITY permit boundary utilizing existing GWMWs. In a letter dated June 21, 2011 in response to the annual 2010 groundwater monitoring report, the TCEQ directed that a perimeter LFG monitoring probe network be installed in accordance with *30 TAC § 330.371 (h)* and *(i)*. A permit modification application (PMA) addressing this directive was submitted to the TCEQ on February 15, 2013. Subsequent to TCEQ approval of the PMA in correspondence dated April 1, 2013, a total of seven landfill gas detection probes were installed on April 23, 2013 along the FACILITY perimeter based on consideration of historical LFG monitoring data, the locations of underground sewer and natural gas utility trenches, and results of a bar probe study conducted in October 2011. Probe construction details are shown on ***Figure 2 – Existing Landfill Gas Probe Detail***.

Following establishment of the perimeter LFG monitoring network, quarterly LFG monitoring activities were conducted during the second and third quarters of 2013 utilizing the newly installed LGDPs located along the FACILITY boundary. In the fourth quarter of 2013, methane gas was detected at a concentration greater than 5 percent (%) volume in air at LGDP-6 during a quarterly LFG monitoring event conducted on September 6, 2013. Upon confirmation of methane detection monitoring results exceeding 5% volume in air measured at the FACILITY boundary on September 23, 2013, response actions undertaken included notification procedures and the establishment of 13 ambient air monitoring stations (AS-1 through AS-13 – See ***Figure 1***) along the FACILITY perimeter, as well as increasing the LFG monitoring frequency from quarterly to monthly. Monthly perimeter LFG monitoring results have been reported quarterly from the fourth quarter 2013 to the present, due to continued methane gas detections greater than 5% volume in air in select perimeter LFG monitoring probes. Since monthly perimeter LFG detection monitoring was initiated in September 2013, methane gas has been detected at concentrations exceeding 5% volume in air in probes LGDP-3, LGDP-4, LGDP-6 and LGDP-7.

Monthly perimeter LFG detection monitoring results for the second quarter of 2015 were reported in a quarterly monitoring report dated July 27, 2015, to which the TCEQ MSW Permits Section acknowledged receipt in correspondence dated September 17, 2015. In this correspondence, the TCEQ directed that, *"Based on the 2015 LFG monitoring results, additional remedial measures are required as soon as practicable along the northern and eastern facility boundary in accordance with 30 TAC §330.371(c).*

On June 29, 30 and July 1, 2016, a bar probe survey was conducted to assess the elevated perimeter methane levels to determine "*the nature and extent of the problem and a proposed remedy*" pursuant to *30 TAC §330.371 (c)(3)*. Fourteen soil borings (i.e., bar probe assessment sampling stations) were installed at the facility northern, northeastern and southeastern perimeters to depths of 25 feet below existing grade surface (bgs). Landfill gas concentrations were measured at 5-foot intervals utilizing soil vapor sampling procedures. Downhole methane levels were detected at depths on the order of 20 to 25 feet below grade surface (bgs) in bar probe borings located proximal to LGDP-3, LGDP-4 and LGDP-6, coincident with a transition from silty and/or sandy clay strata to slightly clayey sand and/or poorly graded fine sand. As the sand stratum is more permeable than the overlying clay stratum to ground surface, this finding is consistent with fact that methane gas migration occurs by diffusion (i.e., a pressure gradient) along the path of least resistance, with the sand stratum providing a "preferential pathway" for gas (i.e., methane) migration relative to the relatively impermeable overlying clay strata.

In order to intercept methane gas presumably migrating from the FACILITY waste disposal areas to the three out of compliance perimeter probes (i.e., LGDP-3, LGDP-4 and LGDP-6), and following from bar probe survey findings, on October 25 through 28, 2016, three batteries of four passive SVE vents were installed between FACILITY waste cells B, C and I and LGDP-3, LGDP-4 and LGDP-6, respectively, totaling 12 SVE vent installations. SVE vent locations are shown as insets on ***Figure 3 – SVE Vent Location Map***. Within each of the three batteries, the four passive SVE vents were constructed approximately 25 feet apart and screened over 10-foot depth intervals within a sand stratum observed to exhibit elevated methane levels during the bar probe survey, with the objective to provide an approximate 100^{+}-foot zone to vent the subsurface of methane gas prior to it reaching these LGDPs. Graphical boring logs and State of Texas Well Reports depicting and describing encountered subsurface conditions and passive SVE vent construction details are provided as ***Attachment A***.

3.0 SITE CHARACTERISTICS §330.371 (B)

The following subsections describe the soil, hydrogeologic, and hydraulic conditions beneath and in the vicinity of the FACILITY, and are based on a review of published geologic and groundwater information and boring logs created in conjunction with past phases of site characterization and assessment and landfill gas vent, groundwater monitoring/assessment well and landfill gas detection probe installations.

The potential for LFG migration is influenced as a function of pressure gradients as well as soil conditions and state of saturation (i.e., varying porosity/permeability as related to preferential pathways). Coarse, porous soil such as sand and gravel allow greater lateral gas migration than finer soils such as clay. The following information was considered and used as the basis for the type and frequency of LFG monitoring, as well as in the development of the LGDP and subsequent SVE vent installation plans.

3.1 Soil Conditions

According to lithologic data in boring logs for the FACILITY and its immediate surroundings, subsurface soil conditions can be described as three generalized strata. The FACILITY LGV, GWMW, LGDP and SVE vent locations for the associated soil boring data referenced below are shown on ***Figure 1.***

Stratum I

Stratum I consists of light gray to tan, stiff to hard sandy to silty clay and clay with lenses of dense silty to clayey sand and localized sand seams extending to depths approximately 10 - 35 feet below ground surface (bgs), corresponding to elevations ranging from 165 - 140 feet above mean sea level (msl). Based on boring logs generated by the URS Corporation during LFG vent installation circa 2004, bottom of the waste mass within the landfill corresponds to elevations ranging from 165 – 145 feet, msl, within the Stratum I clay.

Stratum II

Underlying Stratum I, Stratum II generally consists of loose to dense, poorly graded tan and gray to orange and reddish brown and pink sand that coarsens downward, with lenses of silty sand, fine gravel and highly plastic clay seams extending to depths of approximately 55-75 feet bgs,

corresponding to elevations ranging from approximately 120-100 feet msl. The Stratum II sand, in addition to silty sand and gravel lenses, constitutes the uppermost groundwater-bearing unit (GBU) beneath the FACILITY.

Stratum III

Stratum II is underlain by Stratum III, which consists of stiff to hard, tan to reddish brown and light gray sandy to silty clay and clay with occasional red mottling encountered at depths ranging from approximately 55 feet bgs to at least 75 ft bgs. Stratum III clay was encountered between 55 feet bgs and 75 feet bgs in the majority of borings advanced to these depths throughout the FACILITY. The lateral continuity of the Stratum III clay, and the occurrence of groundwater immediately overlying it, indicate that Stratum III is the lower confining unit beneath the uppermost GWBU in the vicinity of the FACILITY.

3.2 Hydrogeologic Conditions

Regional Groundwater Conditions – Chicot Aquifer

Information available on the Texas Water Development Board (TWDB) water well information database, including drillers' logs for 19 water supply wells installed within a 0.5 mile radius of the FACILITY and two irrigation wells installed adjacent to and approximately 1.5 miles from the FACILITY was reviewed. A large majority of the well logs noted the presence of clay strata at depths ranging from 35 feet bgs to 126 feet bgs, at thicknesses ranging from 15 feet to 84 feet, indicating the lateral continuity of the Stratum III clay observed beneath the FACILITY and throughout the surrounding area. One of the 19 logs reviewed indicated a public water supply well screened from 461 – 491 feet bgs. Screened intervals in the remaining 18 wells ranged from 121 – 129 feet bgs to 364 – 384 feet bgs, with the majority of wells screened at various depths between 180 – 325 feet bgs in sand and gravel. These wells are reportedly screened in the Chicot Aquifer according to data provided in the TWDB Groundwater Database.

According to TWDB *Report 136, Ground-water Resources of Montgomery County* dated November 1971, the Chicot Aquifer generally consists of unconsolidated reddish sands and gravels to an approximate thickness of up to 200 feet, has a general dip (southward, toward the Gulf of Mexico) at its base of approximately 10 feet per mile, and has an average coefficient of permeability of 500 gallons per day/ft^2. The Chicot Aquifer is continuous in the southern part of Montgomery County, which borders the City of Tomball in Harris County approximately two miles north of the FACILITY at Spring Creek.

The Chicot Aquifer is contained entirely within Pleistocene and Holocene-aged sediments, and includes all the sediments below land surface to the top of the Evangeline Aquifer. The Chicot Aquifer, along with the underlying Evangeline Aquifer, regionally comprises the Gulf Coast Aquifer system, which is classified by the TWDB as a major aquifer. The Chico Aquifer is primarily composed of the Willis Sand, Bentley, and Montgomery Formations, Beaumont Clay and Quaternary alluvium, in order from oldest to youngest and deepest to shallowest. In east Texas, the base of the Chicot Aquifer consists of the Willis Sand. The majority of the previously referenced water wells surrounding the FACILITY are screened in this stratum. Overlying the Willis Sand are the Bentley and Montgomery Formations, in which the FACILITY monitor wells are screened. Beaumont Clay and overlying alluvium are absent in the FACILITY vicinity.

Shallow Groundwater Conditions at the FACILITY

Consistent with previous semiannual monitoring events, groundwater elevations beneath the FACILITY gauged during the June 2016 monitoring event ranged from 125.10 feet above mean sea level (amsl) (at MW-11) to 97.58 feet amsl (at MW-14). Groundwater elevations gauged during the December 2016 monitoring event ranged from 125.47 feet amsl (at MW-11) to 96.29 feet amsl (at MW-14). Throughout the western half of the FACILITY, groundwater flow is generally directed to the east, at an average gradient of 0.013 feet/feet as measured between wells MW-5 and MW-14. In the eastern portion of the FACILITY, groundwater flow appears to be directed to the west-northwest, at a relatively steep average gradient of 0.036 feet/feet, as measured between wells MW-11 and MW-14. The general eastward and northward groundwater flow direction in the uppermost GWBU is consistent with local topography and presumed eventual discharge to Spring Creek or its tributaries, which is located approximately two miles north of the FACILITY. The northwestward groundwater flow direction along the eastern portion of the FACILITY is likely influenced by the re-routing of the Boggs Gully drainage feature from historically west and north of the landfill perimeter to its current orientation along the southern and eastern perimeters. Boggs Gully receives surface water drainage from upstream watershed areas that discharge to this drainage feature near the southeastern corner of the FACILITY.

Additional potential influences on the shallow hydrogeologic system include a nearby pond located to the east of the FACILITY and/or other unidentified contributory sources which may cause an artificial groundwater recharge condition at the eastern portion of the landfill. Overall, since its construction and permitting, groundwater elevations and associated gradients in the uppermost GWBU beneath the FACILITY have potentially been influenced by factors including water losses from Boggs Gully and landfill cover repairs and replacements that have improved surface drainage capacity throughout the FACILITY.

3.3 Hydraulic Conditions

In general, the closed landfill is topographically higher than surrounding property. Storm water falling on the FACILITY is drained from the landfill cap by sheet-flow, which enters established channels along the landfill perimeter and exits the permitted property at outfalls located in the northwest, northeast and southern portions of the FACILITY. Erosion is controlled by degree of slope and vegetative cover. Annual inspections have indicated that the outfalls are subject to sedimentation and overgrowth of vegetation, and therefore require seasonal maintenance. Ponding of surface water on the landfill cap occurs occasionally due to uneven settling of the final cover. Maintenance of elevation contours and repairing drainage pathways are performed as needed to control surface water ponding. Ultimately, surface water exiting the FACILITY is discharged into Boggs Gully, a channelized drainage feature abutting the landfill on its east and south boundaries. The presence of this drainage feature may have the potential to influence subsurface LFG migration.

3.4 Enclosed Structures Within The FACILITY Boundary

A portable building housing the air compressor associated with the automated leachate recovery system is the only enclosed structure located within the FACILITY property boundaries. The wooden structure dimensions are 4 feet wide, 8 feet long and 7 feet 4 inches high. This enclosed structure is fully vented along its perimeter, but will continue to be monitored for the presence of LFG as described in Section

6.2 of this plan. There have been no methane detections within the shed since its construction in 2012. The air compressor building location is shown on ***Figure 1***.

3.5 Underground Utilities

Two types of underground utilities (i.e., sanitary sewer and petroleum pipelines) transect the FACILITY and/or trend parallel and adjacent to FACILITY boundaries, which are discussed below. The locations and orientations of the underground utilities within and adjacent to the FACILITY are shown on ***Figure 1***.

3.5.1 Sanitary Sewers

One sanitary sewer leading to the CoT wastewater treatment is located immediately adjacent to the FACILITY eastern boundary. A second sanitary sewer is located immediately adjacent to the FACILITY northeast boundary, prior to turning northeast into the CoT wastewater treatment plant.

3.5.2 Petroleum Pipelines

Five underground petroleum pipelines transect the FACILITY that do not cross waste cells as described below:

- A northeast-southwest trending pipeline transects the FACILITY at approximately 165 feet east of the westernmost landfill permit boundary.
- A north-south trending pipeline transects the FACILITY approximately 60 feet east of well MW-3.
- A north-south trending pipeline transects the FACILITY approximately 125 feet east of MW-3.
- The central portion of the FACILITY is transected by a northwest-southeast trending pipeline, from approximately 165 feet east of well MW-2A at the FACILITY southern boundary to approximately 50 feet west of well MW-7 at the northern FACILITY boundary.
- A pipeline transects the northern FACILITY boundary approximately 20 feet north of well MW-16. Approximately 100 feet east of well MW-15 the pipeline turns southeast for an approximate length of 225 feet, then turns to the northeast at approximately 10 feet south of well MW-14.

Access points to the adjacent sewer lines (i.e., existing manways) are suitable for LFG monitoring. As shown on ***Figure 1***, the LGDPs were installed in proximity to underground natural gas lines by design.

4.0 LANDFILL GAS PROGRAM IMPLEMENTATION *§330.371(E, F)*

The CoT will continue to operate and maintain the gas monitoring and control program for the duration of the post-closure care period (which is dependent on VOC detections in groundwater above respective MCLs), or until the CoT has been issued a written authorization from the TCEQ to reduce or eliminate the program. The TCEQ may issue authorization to reduce or eliminate LFG monitoring and control activities based on a demonstration that there is no potential for gas migration into onsite structures or beyond the landfill property boundary, based on appropriate data collection and additional studies.

The CoT (i.e., the landfill owner/operator) may revise the gas monitoring and control systems throughout the remaining post-closure period. Revisions may be necessary to produce a current, effective system for monitoring LFG and to implement an effective control system. Plans for post-closure use of the FACILITY and all post-closure activities will take into account the need to have an ongoing LFG monitoring and control system, and shall not interfere with the function or effective operation of the LFG monitoring and control systems. Any underground utility trenches, including natural gas transmission pipelines or sanitary sewer utilities, which cross the FACILITY boundary, will be monitored for the presence of LFG as a part of the routine monitoring program. However, any such underground utility trenches that are effectively eliminated will not be required to be monitored. Effective elimination of a buried utility at the FACILITY boundary shall mean removal of the pipeline and associated backfill to undisturbed soil for a distance of at least 10 feet from the FACILITY boundary, and filling the resulting excavation with moisture-conditioned compacted clay soil.

5.0 LANDFILL GAS MANAGEMENT PROGRAM *§330.371(G)*

5.1 Landfill Gas Control System

Landfill gas is managed and controlled at the FACILITY by the maintenance of a total of 43 LGVs historically installed within and around the perimeters of waste disposal areas, as well as 12 new SVE vents installed at targeted locations along the FACILITY northeast and southeast perimeters as part of a methane gas remediation plan, as shown on ***Figure 1***. Further description of the FACILITY landfill gas management and control systems is provided in the following subsections.

5.1.1 Landfill Gas Vents

Twenty-seven LGVs (i.e., MV-1 through MV-27) were installed in 2003 along the perimeters of seven of the nine FACILITY waste disposal areas. A LFG survey was conducted in May 2007 to assess the efficacy of additional vents to promote LFG venting through the landfill final cover. On the basis of the LFG survey findings, in September 2007, 16 additional LGVs (i.e., MV-28 through MV-43) were installed within five of the seven monitored waste disposal areas. The LGVs are constructed of 4-inch diameter schedule-40 polyvinyl chloride (PVC) slotted (0.010-inch) screen of varying lengths and solid PVC casing to approximately 2 feet above ground surface. Each LGV was installed in an 8.25-inch diameter borehole advanced using hollow-stem auger drilling methods. The annular space within each LGV between the PVC screen/casing and borehole wall was filled with 0.5/1-inch gravel, and was sealed with a minimum of 2 feet of hydrated granular bentonite during construction. All LGVs are completed at ground surface with a 2-foot by 2-foot concrete pad. The top of each LGV is fitted with a metal rotating turbine cap to promote LFG venting and prevent rainfall infiltration.

Throughout the FACILITY post-closure monitoring period up to the fourth quarter of 2013, LVGs have been inspected and monitored for LFG on a quarterly basis to track their integrity and localized methane generation. During the fourth quarter of 2013 and up to the present the 43 LVGs have been inspected for integrity, repaired as necessary, and monitored for LFG on a monthly basis, which will be continued.

5.1.2 Passive Soil Vapor Extraction Vents

As part of a TCEQ-directed remedial action, in order to intercept methane gas presumably migrating from the FACILITY waste disposal areas to three out of compliance perimeter probes (i.e., LGDP-3, LGDP-4 and LGDP-6), three batteries of four passive SVE vents were installed in October 2016 between FACILITY waste cells B, C and I and LGDP-3, LGDP-4 and LGDP-6, respectively, totaling 12 SVE vent installations. The locations of the 12 SVE vents relative to waste cells B, C and I and probes LGDP-3, LGDP-4 and LGDP-6 are shown on ***Figures 1*** and ***3***. Within each of the three batteries, the four passive SVE vents were constructed approximately 25 feet apart and screened over 10-foot depth intervals within a sand stratum observed to exhibit elevated methane levels during the June/July 2016 bar probe survey, with the objective to provide an approximate 100^{+}-foot zone to vent the subsurface of methane gas prior to it reaching these LGDPs.

As depicted in the boring logs provided in ***Attachment A***, each SVE vent was installed in a 10.25-inch diameter borehole advanced using hollow-stem auger drilling methods. The SVE vents were constructed using 4-inch diameter, schedule-40 PVC casing to an appropriate depth bgs and 10 feet of continuously wrapped (wire wrapped) stainless steel screen to maximize gas intake capacity at each vent, as well as for durability in the event that the vents periodically require hydraulic or pneumatic jetting to remove silt from the vent screened interval. Screened intervals ranged from 18-28 feet bgs to 26-36 feet bgs, depending on where the top of the sand stratum (i.e., Stratum II) was encountered at each vent location. The continuously-wrapped screens were end-capped at the screen bottom with a 1-foot stainless steel sump for silt collection.

The annular space between each vent screen and borehole wall was packed with washed 5/8-inch pea gravel to a depth corresponding to 2 feet above the vent screened interval, then sealed and grouted with hydrated granular bentonite to approximately 2 feet bgs. Each vent was completed at ground surface with a 2-foot concrete cap, a 3-foot by 3-foot concrete pad, and an approximate 7-foot PVC stickup in order to vent methane gas to a safe altitude relative to worker combustion source zones. The PVC stickups are set within an approximate 3-foot high protective metal outer casing. The top of each vent casing stickup was fitted with a metal rotating turbine cap, in order to minimize rain water infiltration and create subtle, wind-induced negative pressure to promote methane venting. Each PVC stickup was fitted with a waist-level stopcock valve to facilitate LFG monitoring instrumentation docking. A schematic of SVE vent construction is shown on ***Figure 4 – Typical SVE Vent Construction Diagram***. The SVE vents will be monitored and maintained in a manner similar to the LGVs.

5.2 Leachate Recovery

It is inferred that the infiltration of precipitation raises leachate levels within the FACILITY waste disposal areas, recurrently saturating subsurface waste masses and the screened intervals of select LGVs installed therein, which inhibits LFG venting. It has been conjectured that poor LFG venting, and subsequent LFG migration, may be influencing the occurrence of low levels of chlorinated VOCs in groundwater, which have been periodically detected at select GWMWs.

As it is generally true that leachate recovery from select LGVs is necessary to promote effective LFG venting, the CoT implemented a program of manual LGV leachate removal activities in July of 2008 as a LFG management and control backup plan. In October 2009, the CoT installed a solar-powered leachate pumping system in vents MV-16, MV-23, MV-40 and MV-43, based on monitoring data indicating these LGVs accumulated the greatest volume of leachate and emitted the highest concentrations of methane subsequent to leachate removal. However, after 4 months of operation, leachate recovery by the solar-powered system was discontinued due to operational and maintenance factors. An automated leachate recovery system utilizing more robust pneumatic pumps was installed by the CoT in August 2012 to renew semi-continuous leachate recovery from vents MV-20, MV-40 and MV-43 as necessary to promote and LFG venting and minimize potential LFG migration beneath the southeast portion of the FACILITY, where maximum leachate accumulations have been historically noted. Leachate, intermittently pumped from these LGVs from 2009 to the present, is continuously discharged via above-ground piping directly to the adjacent CoT wastewater treatment plant for treatment and disposal.

In addition to automated LGV leachate recovery, leachate has periodically been manually removed by hand bailing and/or pumped from a majority of the remaining LGVs from July 2008 through 2014, weather conditions permitting. During manual leachate removal events, leachate was not removed from select LGVs due to dry conditions (i.e., insufficient leachate accumulations to pump) or having a fully-exposed screened interval. Manually recovered leachate was temporarily contained within a truck-mounted polypropylene holding tank and transported directly to the adjacent CoT wastewater treatment plant (See ***Figure 1***) for treatment and disposal. In 2015, manual leachate recovery was discontinued, as no correlation between leachate recovery and increased methane venting had been demonstrated accept in waste relocation area I, where semi-continuous leachate recovery is ongoing.

6.0 LANDFILL GAS MONITORING *§330.371(H-K)*

This plan describes the mechanisms and provides the procedures for monitoring for the presence of LFG along the FACILITY permit boundary and the potential for LFG accumulation within onsite structures. The potential for explosive gases to migrate underground is affected by pressure gradients caused by the generation of LFG, as well as geologic and hydrogeological factors considered in plan development.

6.1 Perimeter Landfill Gas Monitoring Network

The FACILITY perimeter LFG monitoring network consists of seven permanent landfill gas detection probes that were installed in April 2013, as described in the **RKEI** report *Perimeter Landfill Gas Detection Probe Installation Report* dated September 9, 2013. Each LGDP was installed in native soil outside the adjacent waste mass boundary to a depth approximating the base of the adjacent waste mass. The LGDPs are distributed to surround the FACILITY, with specific probe locations placed adjacent to areas that have historically exhibited the most significant LFG measurements and on results of the referenced 2011 bar probe study. As shown on ***Figure 1***, LGDP spacing ranges from approximately 225 feet between LGDP-3 and LGDP-4 to approximately 1,170 feet between LGDP-1 and LGDP-7, with wider spacing along the FACILITY southern and western boundaries.

As described in the referenced *Perimeter Landfill Gas Detection Probe Installation Report* subsurface conditions considered regarding LGDP placement for perimeter LFG monitoring included:

- Groundwater mounding at the southeast portion of the FACILITY, considered to be associated with surface water recharge (infiltration) from the adjacent Boggs Gully, likely forms a hydrologic barrier inhibiting LFG migration beyond the FACILITY southeastern permit boundary.
- Low waste thickness and absence of significant LFG measurements along the southwestern and western FACILITY permit boundaries allowed for wider perimeter LGDP spacing in these areas.
- Results of the bar probe study indicated the greatest potential for LFG migration in the north-central portion of the FACILITY, which is in proximity to the CoT wastewater treatment plant.

6.2 Perimeter Landfill Gas Monitoring

FACILITY perimeter boundary monitoring has and will continue to be accomplished by measuring concentrations of landfill gases at the tops of casings of the seven permanent landfill gas detection probes in addition to 13 ambient air monitoring stations established throughout the FACILITY perimeter on a quarterly or more frequent basis if necessary or otherwise required by the TCEQ. LFG monitoring and LGDP maintenance procedures are provided in the following subsections.

6.2.1 Monitoring Procedures

Perimeter LFG monitoring will be conducted at the existing LGDPs by a qualified environmental professional, which will include collection and recording of the following measurements:

- Methane concentration, as measured in percent by volume in air;
- Methane concentration, as measured in percent of methane lower explosive limit (LEL);
- Hydrogen Sulfide (H_2S) concentration, as measured in parts per million (ppm) in air;
- Carbon dioxide (CO_2) concentration, as measured in ppm in air;
- Oxygen (O_2) concentration, as measured in ppm in air; and
- Depth to groundwater (if any), as measured in feet below top of the LGDP inner casing.

Monitoring for LFG composition and concentrations will be performed using a portable Landtec® GEM-2000, or equivalent instrument, capable of measuring the required parameters. The instrument will be calibrated against known methane and oxygen standards prior to each monitoring event. The instrument may also be checked against known gas standards in the event of methane concentration measurements at or near regulatory compliance levels or questionable or suspicious monitoring results.

The LFG monitoring instrument will be calibrated, operated, and maintained in accordance with the manufacturer's recommended procedures. All perimeter LFG measurements will be recorded in the field on the Landfill Gas Monitoring Field Data Form, a copy of which is provided as ***Attachment B***. After LFG levels are measured and recorded, the water level (if any) in, and total depth of, each LGDP will be gauged using an electronic water level indicator to assure that it is not obstructed.

If, as a result of perimeter LFG monitoring, confirmed explosive gas readings that exceed the maximum allowable concentrations (i.e., 100% of the LEL [5% volume in air] for methane), initial response measures and notification procedures as presented in *Sections 7.1* and *7.2*, respectively, of this plan will be implemented by the CoT at the earliest opportunity.

6.2.2 Maintenance Procedures

During each perimeter LFG monitoring event, the integrity of each monitoring network LGDP and monitoring well will be inspected, evaluated and recorded on the Landfill Gas Monitoring Field Data Form. The environmental professional shall perform the following at each monitoring event:

- Verify that each LGDP is clearly identified with a label on the outer casing;
- Verify that each LGDP protective casing is intact and is not bent or excessively corroded;
- Verify that each LGDP concrete pad is intact, with no evidence of cracking or heaving;
- Verify that each LGDP padlock securing the protective outer casing is functional; and
- Verify that each LGDP PVC inner casing is intact and not obstructed.

If damage to a LGDP is observed, it will be noted and reported to the CoT. If it is not possible to repair the affected LGDP and the damage can potentially affect the accuracy of future LFG monitoring results, the affected LGDP will be decommissioned and replaced with a new LGDP.

6.3 FACILITY Structure Monitoring

A portable building housing the air compressor associated with the automated leachate recovery system is the only enclosed structure located within the FACILITY property boundaries. The wooden structure dimensions are 4 feet wide, 8 feet long and 7 feet 4 inches high. Although this enclosed structure is fully vented along its perimeter, it will be monitored during each perimeter LFG monitoring event with a portable combustible gas indicator (CGI) that will provide an audible alarm if methane concentrations exceed 1.25% methane by volume in air. The CGI will be calibrated, operated, and maintained in accordance with the instrument manufacturer's recommended procedures. If allowable methane concentration limits are exceeded within the monitored enclosed structure, the building will be immediately evacuated and adequately ventilated.

6.4 Response Plan for Damaged Landfill Gas Detection Probes

The following response plan will be utilized in the event that any permanent LGDP becomes unusable:

1. Damaged or otherwise inoperative perimeter LGDPs will be repaired within 30 days of the date the damage is reported, or replaced within 60 days from the TCEQ MSW Permits Section approval date of the permit modification application for the permanent LGDP replacement(s).
2. Upon installation of the replacement LGDP(s), an installation report including boring log(s) and LGDP construction details will be submitted to the TCEQ MSW Permits Section for review.
3. Should a quarterly perimeter LFG monitoring event occur prior to damaged LGDP replacement, an adjacent bar hole will be placed so that LFG monitoring at that location can be accomplished.

6.5 Monitoring Frequency

LGDPs, as well as onsite enclosed structure(s) will be monitored quarterly. Those locations where quarterly LFG monitoring results indicate that methane accumulation is occurring in onsite enclosed structures (i.e., is measured at concentrations equal to or greater than 1.25% volume in air) or at the

FACILITY perimeter (i.e., is measured at concentrations equal to or greater than 5% volume in air) will initially be monitored monthly thereafter, in accordance with *30 TAC 330.371(k)(2)*. Any perimeter LFG monitoring station exhibiting no methane detections exceeding 5% volume in air for three consecutive months (i.e., a calendar quarter) will revert back to a quarterly monitoring frequency pending TCEQ approval.

6.6 Recordkeeping and Reporting

Perimeter LFG monitoring measurements, field observations and LGDP inspection information will be recorded the Landfill Gas Monitoring Field Data Form**.** Field monitoring data will be maintained in the FACILITY operating record. Currently, perimeter LFG monitoring is conducted on a monthly basis, with monitoring results reported quarterly. Quarterly perimeter LFG reporting will be continued as long as the monitoring frequency is monthly, but will be transitioned back to annually when perimeter LFG monitoring reverts back to a quarterly basis. Monthly perimeter LFG monitoring data for the fourth quarter of each calendar year, in addition to all previous LFG measurements from that year, will be tabulated and reported annually with a compliance evaluation and recommendations in an Annual Landfill Gas Monitoring Report. All perimeter LFG monitoring records (in the form of annual landfill gas monitoring reports) will be maintained in by CoT in their FACILITY post-closure care files.

Record keeping and reporting requirements in the event that explosive gas readings exceed the maximum allowable concentrations as discussed in Section 7.4 pertaining to the Response Action Plan.

7.0 RESPONSE ACTION PLAN *§330.371(C, D)*

This action plan has been prepared for the protection of human health in the event concentrations of methane exceed applicable regulatory levels within enclosed structures or at the FACILITY permit boundary, while recognizing that a single methane gas exceedence on a LFG instrument or a CGI alarm does not necessarily mean that a methane concentration has actually exceeded allowable levels.

7.1 Initial Response Measures

Initial action in the event methane is detected at levels above regulatory limits is to protect human health. Similar to recently implemented remedial action involving SVE vent installation, a specific response measure will be developed in consideration of the specific LFG situation. Response measures will be developed and implemented in accordance with procedures set forth in the following subsections.

7.1.1 Emergency Actions

During quarterly LFG monitoring, if LFG detection equipment indicates that the methane concentration has exceeded 1.25% by volume in air within an enclosed structure (i.e., the air compressor shed), the structure will be evacuated of all personnel immediately, and the CoT will immediately be notified. Personnel other than authorized monitoring personnel will not be allowed to re-enter the affected

enclosed structure(s) until additional measures (i.e., adequate ventilation and LFG retesting) are taken. If methane levels above 5% by volume in air are detected at the FACILITY permitted boundary, the CoT will immediately be notified.

7.1.2 Verification Procedures

Once emergency measures have been taken to protect human health, the CoT will require LFG monitoring personnel to begin verification procedures. Such procedures are intended to determine if the initial measurements were accurate, or if erroneous levels have been detected due to equipment malfunction or other factors. LFG field monitoring data records will be maintained in the FACILITY files.

Enclosed Structures – Verification of detected methane concentration exceedence in enclosed structures will be conducted within 24 hours by properly trained personnel using the following procedures:

- Monitor methane levels throughout the structure using a properly calibrated portable gas indicator. Readings will be taken in each room and in confined spaces (i.e., closets, cupboards, etc.). If there are natural gas appliances in the structure, they should be checked for leaks.
- If subject structure is to be used for continued occupancy, or if methane migration is suspected, evaluate the requirement for installation of continuous monitoring equipment in the structure.

If methane concentrations above the regulatory limit are not detected (i.e., a malfunction or erroneous reading is suspected), personnel may return to the enclosed structure. However, methane monitoring with a CGI will continue daily for one week after the initial exceedence. If methane levels above the regulatory limit are not detected during that week, daily monitoring will cease and quarterly monitoring will resume. If methane levels above the regulatory limit are detected during initial verification procedures or during the follow-up procedures in the ensuing week, notification and remediation procedures must be implemented, as described in *Sections 7.2* and *7.3* of this document, respectively.

Permit Boundary – Verification of methane levels above the regulatory limit at perimeter LFG monitoring points will be conducted within 24 hours by properly trained personnel using the following procedures:

- Recalibrate LFG detection equipment according to the manufacturer's instructions;
- Immediately recheck the methane concentration in the perimeter LFG monitoring point(s);
- Recheck the methane concentration at the exceeding location(s) again within 7 days.

If methane levels above the regulatory limit (i.e., 5% volume in air) are not detected in the above verification procedure, routine (i.e., quarterly) perimeter LFG monitoring procedures will resume. In the event methane concentrations above the regulatory limit have been verified in one or more

perimeter LFG monitoring points during the verification procedures, notification and methane remediation procedures must be implemented, as described in *Sections 7.2* and *7.3* of this document, respectively.

7.2 Notification Procedures

When methane concentrations above applicable regulatory limits have been verified within an enclosed structure or perimeter LFG monitoring point, notification procedures will be enacted immediately in accordance with *30 TAC §330.371(c)(1)*. Notifications will be made to the TCEQ MSW Permits Section and Region 12 office, Harris County officials, CoT officials, local emergency responders, and the public.

When methane levels above regulatory limits have been verified, within seven days the CoT will place documentation of the detected methane levels in the FACILITY operating record as well as a description of steps taken to ensure protection of human health in accordance with *30 TAC §330.371 (c)(2)*.

7.3 Methane Gas Release Remediation Plan

If verification procedures confirm methane levels above regulatory limits in enclosed structures or at the FACILITY permit boundary, concurrent with notification requirements stipulated in *30 TAC §330.371(2)(c)(1),* remedial action(s) will be implemented within 60 days in accordance with *30 TAC §330.371(c)(3)*. In addition to the required increase in LFG monitoring frequency per *30 TAC §330.371(k)(2)*, an assessment investigation of the source(s) and cause(s) of the elevated methane levels will be conducted to evaluate and to "*describe the nature and extent of the problem and a proposed remedy*".

The investigation may include some or all of the following elements, depending on the circumstances:

- Bar probe (I.e., DPT soil gas testing) in the vicinity of affected perimeter monitoring point(s);
- Laboratory analyses of LGDP gas sample(s) to determine methane, carbon dioxide, nitrogen and other trace LFG gas (including non-methane organic compounds [NMOCs]) concentrations;
- Installation of additional monitoring points (i.e., gas monitoring probes or soil gas vapor probes).

An assessment will then be made to determine an appropriate course of action to mitigate the offsite methane gas migration. A methane gas release remediation plan will be submitted as a permit modification application to include any changes in the LFG control or monitoring networks, installation of additional LFG monitoring points, or construction of additional SVE vents or any other changes requiring permit modification. The remediation plan, based on results of the investigation, will be submitted to the TCEQ within 60 days of detection. Copies of the remediation plan will be placed in the FACILITY operating files and provided to the TCEQ with verification that the plan has been implemented.

7.4 Recordkeeping and Reporting Procedures

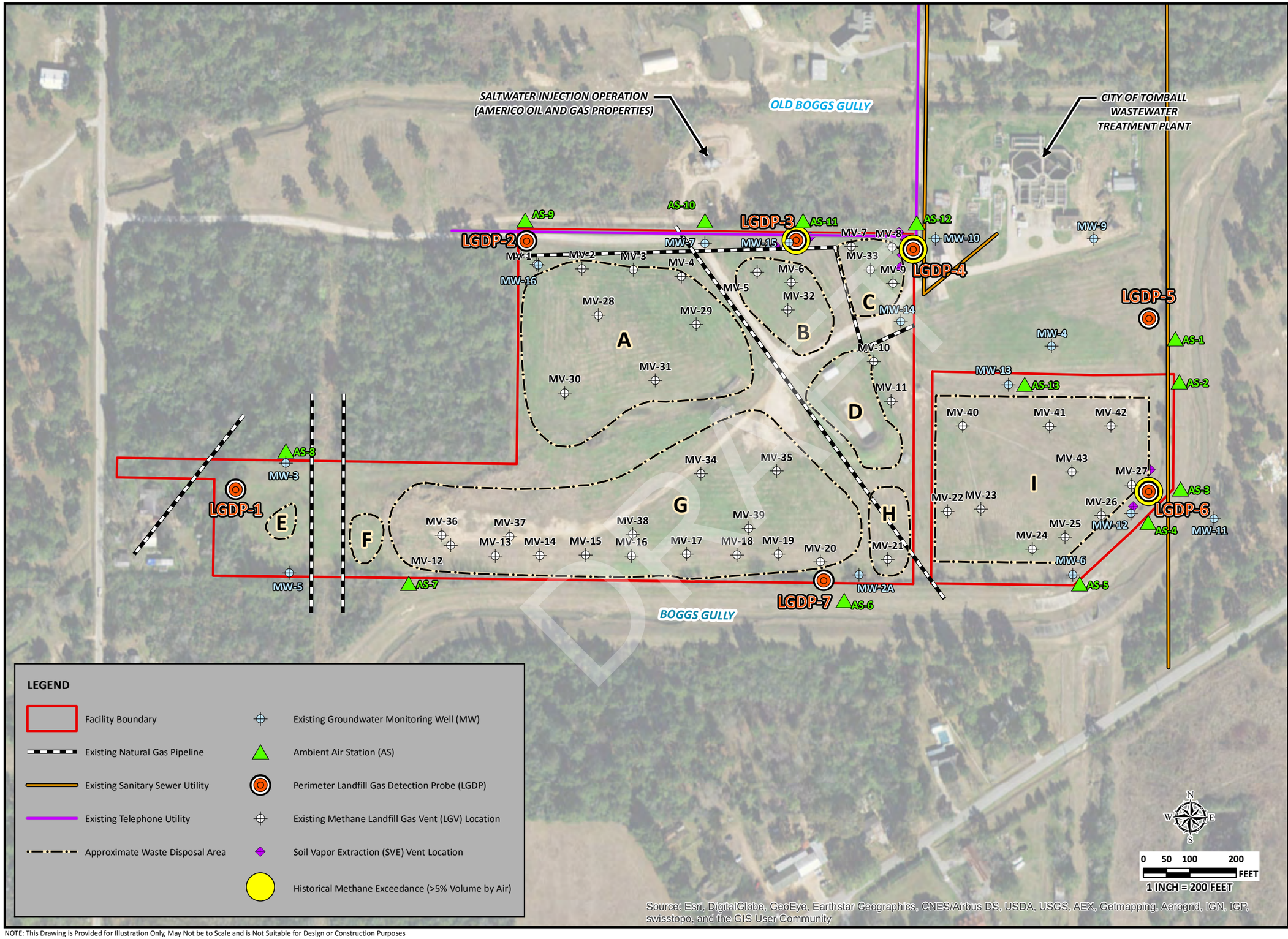
The following records and reporting will be required during implementation of the Response Action Plan as a result of explosive gas readings that exceed the maximum allowable concentrations:

1. The CoT will notify those person/agencies listed in *Section 7.2*. This notification will be made via telephone or written correspondence promptly upon discovery of the exceedence.
2. The results of follow-up sampling to determine the extent of explosive gas migration will be documented.
3. Within seven days of the exceedence, a brief report will be written and placed in the FACILITY post-closure care records, which describes the following:
    a. The date, location and magnitude of the initial readings which exceed the allowable maximum percent LEL (i.e., 5% methane by volume in air);
    b. The actions taken following the initial reading to protect human health; and
    c. Information regarding the required notification of the executive director, local and county officials and residents within ¼ mile feet of the reading.
4. Within 60 days of detection of the exceedence, a remediation plan will be prepared and submitted to the TCEQ and placed in the FACILITY post-closure care records. The plan will describe the nature and extent of the problem and the proposed remedy. After review, the TCEQ may require additional remedial measures.

7.5 Alternative Schedules for Demonstrating Compliance

It is noted, per §330.371(d), that the executive director may establish alternate schedules for demonstrating compliance with elements of this section for the protection of human health.

FIGURES



RABA KISTNER ENVIRONMENTAL
Raba Kistner Environmental, Inc.
12821 West Golden Lane
San Antonio, Texas 78249
www.rkci.com
P 210 :: 699 :: 9090
F 210 :: 699 :: 6426
TBPE Firm F-3257 / TBPG Firm F-50220

SITE PLAN

LANDFILL GAS MANAGEMENT PERMIT MODIFICATION
PERIMETER LANDFILL GAS MONITORING
CLOSED CITY OF TOMBALL LANDFILL - HARRIS COUNTY
MSW PERMIT No. 1140A
RN102120755/CN600667190

REVISIONS:

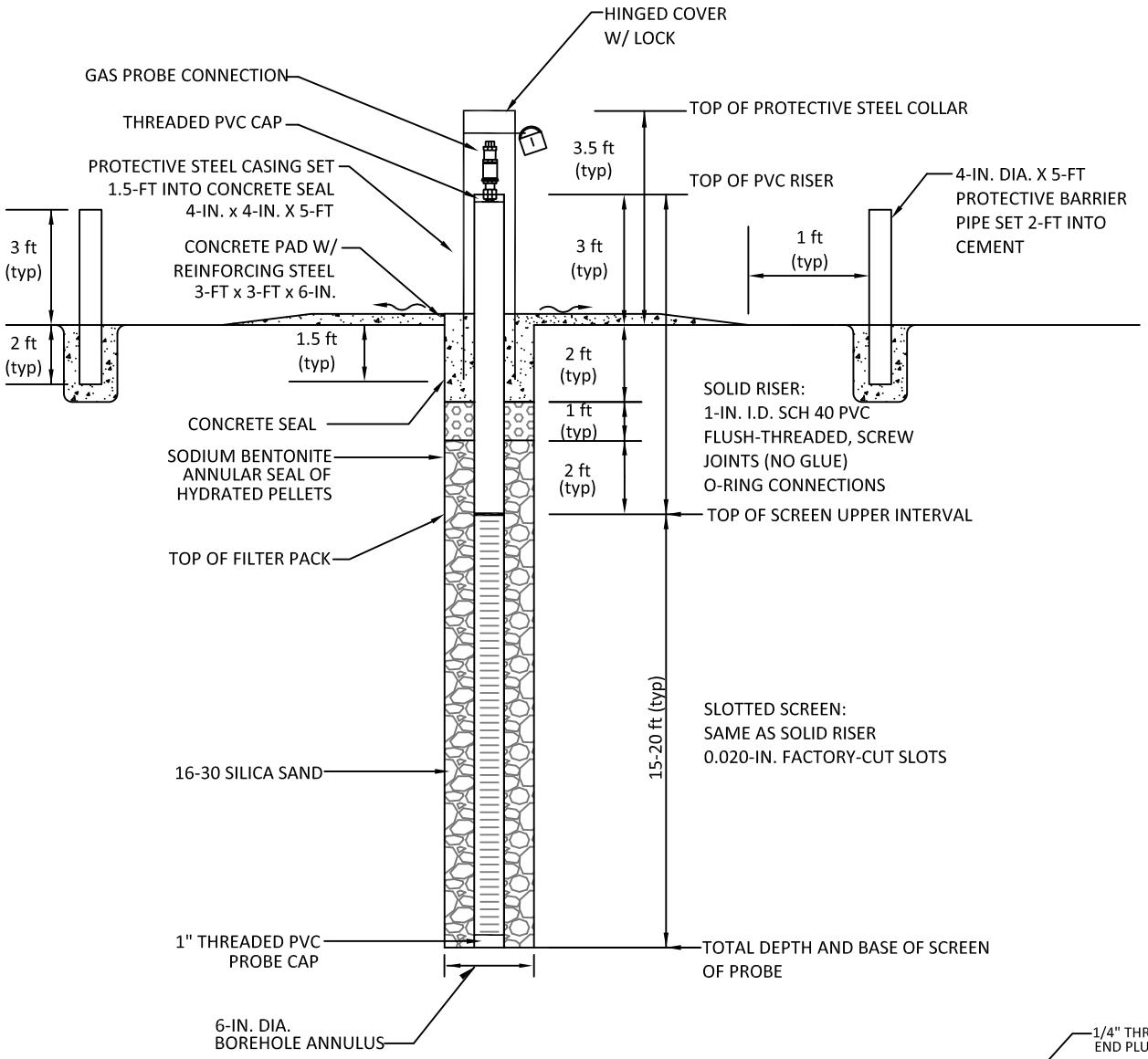
No.	DATE	DESCRIPTION

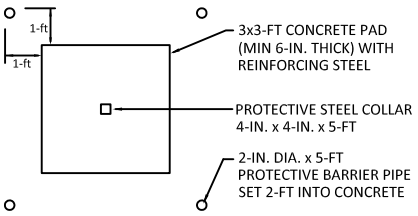
PROJECT No.:	ASF06-456-35
ISSUE DATE:	01-18-17
DRAWN BY:	LAW/CCL
CHECKED BY:	PMS
REVIEWED BY:	RVK

FIGURE

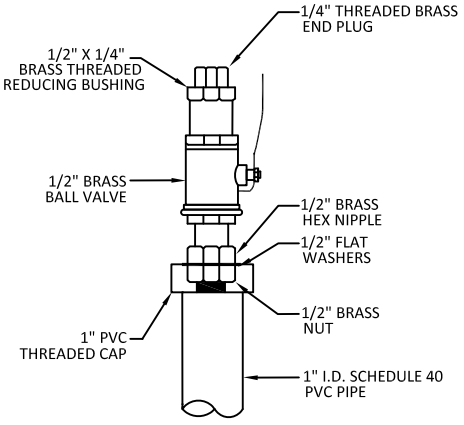
1

NOTE: This Drawing is Provided for Illustration Only, May Not be to Scale and is Not Suitable for Design or Construction Purposes





TOP VIEW
N.T.S.



GAS PROBE
CONNECTION DETAIL
N.T.S.

RABA KISTNER CONSULTANTS
Raba Kistner Consultants, Inc.
12821 West Golden Lane
San Antonio, Texas 78249
www.rkci.com
P 210 :: 699 :: 9090
F 210 :: 699 :: 6426
TBPE Firm F-3257 / TBPG Firm #50220

EXISTING LANDFILL GAS PROBE DETAIL

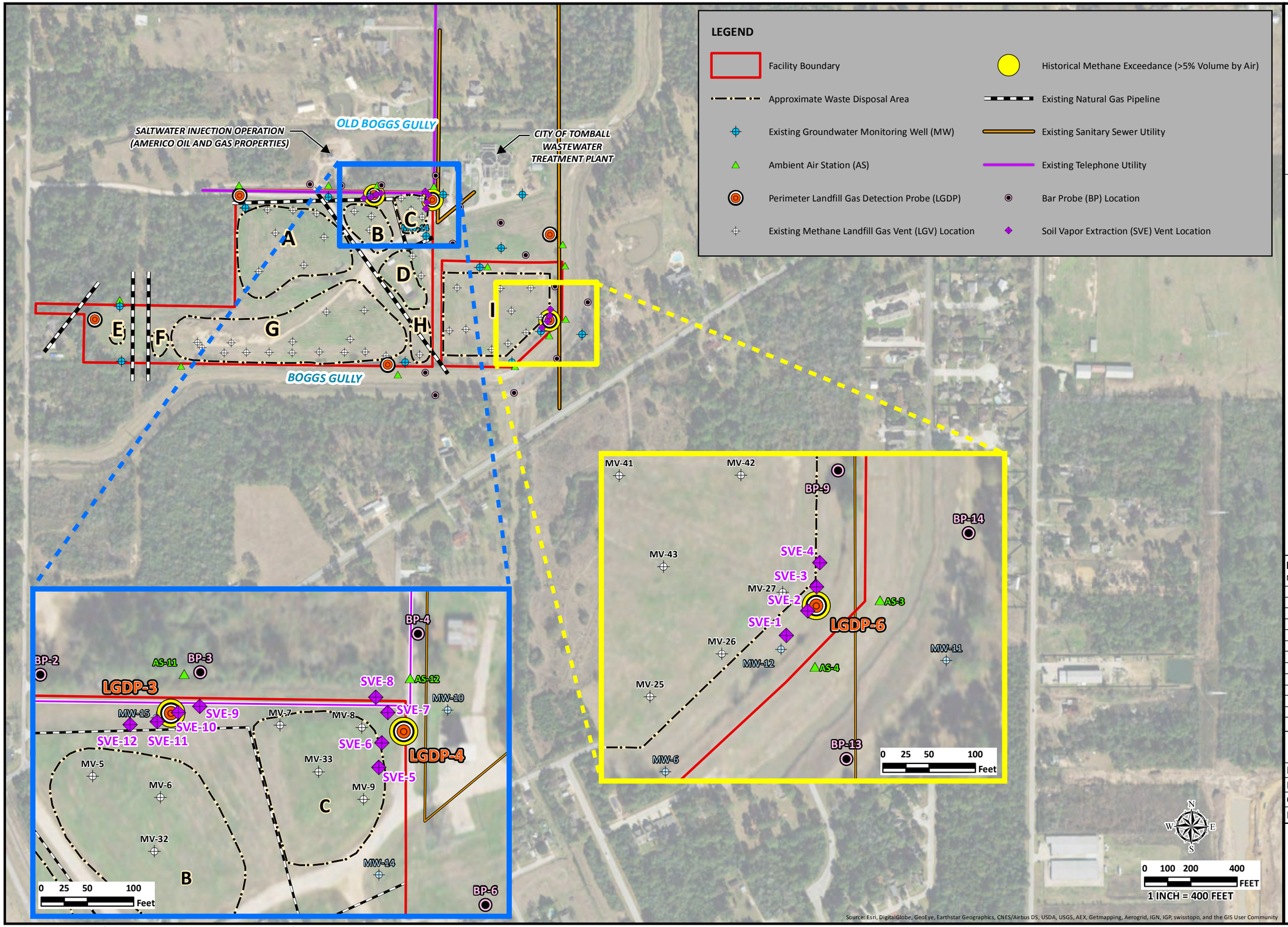
LANDFILL GAS MANAGEMENT PERMIT
MODIFICATION
CLOSED CITY OF TOMBALL LANDFILL
HARRIS COUNTY - MSW PERMIT No. 1140A
RN102120755/CN600667190

REVISIONS:

No.	DATE	DESCRIPTION

PROJECT No.:	ASF06-456-35
ISSUE DATE:	01-18-17
DRAWN DATE:	LAW
CHECKED BY:	PMS
REVIEWED BY:	RVK

FIGURE
2



RABA KISTNER ENVIRONMENTAL
Raba Kistner Environmental, Inc.
12821 West Golden Lane
San Antonio, Texas 78249
www.rkci.com
P 210 :: 699 :: 9090
F 210 :: 699 :: 6426
TBPE Firm F-3257 / TBPG Firm #50220

SVE VENT LOCATION MAP

LANDFILL GAS MANAGEMENT PERMIT MODIFICATION
PERIMETER LANDFILL GAS MONITORING
CLOSED CITY OF TOMBALL LANDFILL - HARRIS COUNTY
MSW PERMIT No. 1140A
RN102120755/CN600667190

REVISIONS:

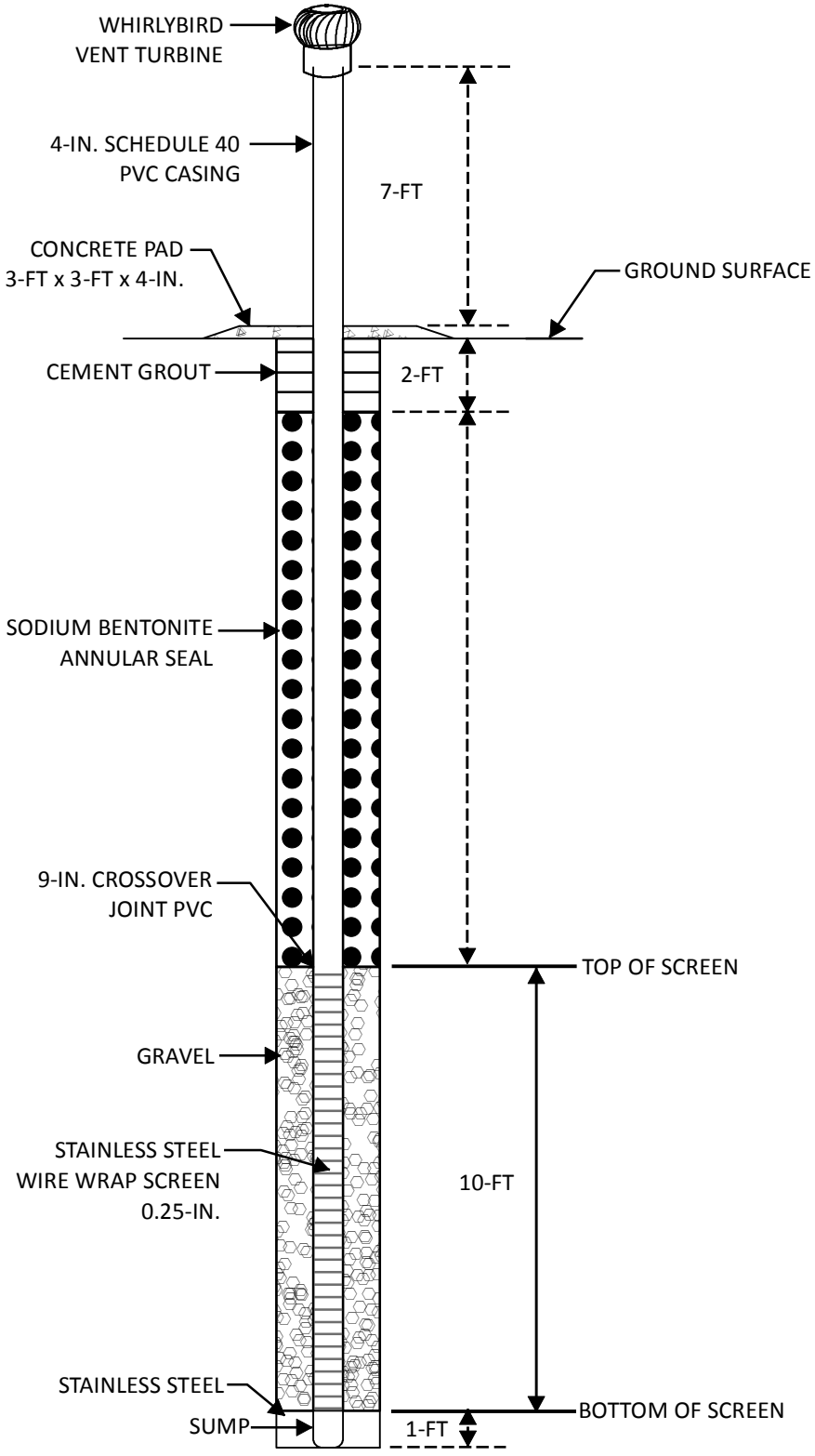
No.	DATE	DESCRIPTION

PROJECT No.:	ASF06-456-35
ISSUE DATE:	01-18-17
DRAWN BY:	LAW
CHECKED BY:	PMS
REVIEWED BY:	RVK

FIGURE

3

NOTE: This Drawing is Provided for Illustration Only, May Not be to Scale and is Not Suitable for Design or Construction Purposes



RABA KISTNER ENVIRONMENTAL
Raba Kistner Environmental, Inc.
12821 West Golden Lane
San Antonio, Texas 78249
www.rkci.com
P 210 :: 699 :: 9090
F 210 :: 699 :: 6426
TBPE Firm F-3257 / TBPG Firm #50220

TYPICAL SVE VENT CONSTRUCTION DIAGRAM

CLOSED CITY OF TOMBALL LANDFILL
HARRIS COUNTY
MSW PERMIT No. 1140A
RN 102120755/CN600667190

REVISIONS:

No.	DATE	DESCRIPTION

PROJECT No.:	ASF06-456-35
ISSUE DATE:	01-18-17
DRAWN BY:	LAW
CHECKED BY:	PMS
REVIEWED BY:	RVK

FIGURE

4

NOTE: This Drawing is Provided for Illustration Only, May Not be to Scale and is Not Suitable for Design or Construction Purposes

ATTACHMENT A

SVE BORING LOGS
STATE OF TEXAS WELL REPORTS

LOG OF BORING NO. SVE-1

Closed City of Tomball Landfill - MSW Permit No. 1140A
RN102120755 / CN600667190
Harris County, Texas

RABA KISTNER
TBPE Firm Registration No. F-3257

DRILLING METHOD: Hollow Stem Auger

LOCATION: UTM NAD83 Z15, meters (N3333811, E248547)

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	FORMATION	PIEZOMETER	OVA (ppm)	LABORATORY ANALYSES (ppm) B	T	E	X	TPH	% -200
0			CLAY, Silty, Stiff, Light Brown, Moist			0						
5						0						
10			- brown to orangish-brown from 10' to 13'			0.5						
15			- light brown to tan from 13' to 15' - tan below 15'			0.5						
20			SAND, Loose, Tan, Moist			0.2						
25						0.1						
30			Boring terminated at 30.0 ft.									
35												
40												

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT

DEPTH DRILLED:	30.0 ft	**DEPTH TO WATER:**	Dry	**PROJ. No.:**	ASF06-456-35
DATE DRILLED:	10/25/2016	**DATE MEASURED:**	10/25/2016		

LOG OF BORING NO. SVE-2

Closed City of Tomball Landfill - MSW Permit No. 1140A
RN102120755 / CN600667190
Harris County, Texas

RABA KISTNER
TBPE Firm Registration No. F-3257

DRILLING METHOD: Hollow Stem Auger

LOCATION: UTM NAD83 Z15, meters (N3333819, E248554)

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	FORMATION	PIEZOMETER	OVA (ppm)	LABORATORY ANALYSES (ppm) B	T	E	X	TPH	% -200
0			CLAY, Silty, Firm, Brown, Moist			0.9						
			- dark brown from 3' to 6'									
5						1.4						
10			- orangish-brown from 11' to 17'			1.2						
15			- light brown to tan from 17' to 21'			0.8						
20			- reddish-brown below 21'									
			SAND, Loose, Tan, Moist			1.5						
25						0.8						
30												
			Boring terminated at 33.0 ft.									
35												
40												

DEPTH DRILLED: 33.0 ft
DATE DRILLED: 10/25/2016

DEPTH TO WATER: Dry
DATE MEASURED: 10/25/2016

PROJ. No.: ASF06-456-35

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT

LOG OF BORING NO. SVE-3

Closed City of Tomball Landfill - MSW Permit No. 1140A
RN102120755 / CN600667190
Harris County, Texas

RABA KISTNER
TBPE Firm Registration No. F-3257

DRILLING METHOD: Hollow Stem Auger

LOCATION: UTM NAD83 Z15, meters (N3333827, E248557)

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	FORMATION	PIEZOMETER	OVA (ppm)	LABORATORY ANALYSES (ppm) B	T	E	X	TPH	% -200
0			CLAY, Silty, Firm, Brown, Moist			1.6						
5			- moist to wet at 7'			2.0						
10			- sandy, gray, wet below 12'			0.8						
15			SAND, Clayey, Brown, Wet to Saturated									
			CLAY, Sandy, Brown, Wet to Saturated - GROUNDWATER encountered at 17'			0						
20												
			CLAY, Silty, Firm, Brown to Tan, Wet to Moist			1.2						
25			SAND, Loose, Tan, Moist									
						1.0						
30												
						0.1						
35			Boring terminated at 36.0 ft.									
40												

DEPTH DRILLED:	36.0 ft	**DEPTH TO WATER:**	17.0 ft	**PROJ. No.:**	ASF06-456-35
DATE DRILLED:	10/25/2016	**DATE MEASURED:**	10/25/2016		

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT

LOG OF BORING NO. SVE-4

Closed City of Tomball Landfill - MSW Permit No. 1140A
RN102120755 / CN600667190
Harris County, Texas

RABA KISTNER
TBPE Firm Registration No. F-3257

DRILLING METHOD: Hollow Stem Auger

LOCATION: UTM NAD83 Z15, meters (N3333835, E248558)

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	FORMATION	PIEZOMETER	OVA (ppm)	LABORATORY ANALYSES (ppm) B	T	E	X	TPH	% -200
0			CLAY, Silty, Firm, Brown, Moist			1.0						
5						0.3						
10			- reddish-brown from 10' to 18'			1.1						
15						2.3						
20			- light brown below 18'									
			SAND, Loose, Tan, Moist			0.9						
25						1.2						
30												
35			Boring terminated at 33.0 ft.									
40												

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT

DEPTH DRILLED:	33.0 ft	**DEPTH TO WATER:**	Dry	**PROJ. No.:**	ASF06-456-35
DATE DRILLED:	10/26/2016	**DATE MEASURED:**	10/26/2016		

LOG OF BORING NO. SVE-5

Closed City of Tomball Landfill - MSW Permit No. 1140A
RN102120755 / CN600667190
Harris County, Texas

RABA KISTNER
TBPE Firm Registration No. F-3257

DRILLING METHOD: Hollow Stem Auger

LOCATION: UTM NAD83 Z15, meters (N3333968, E248394)

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	FORMATION	PIEZOMETER	OVA (ppm)	LABORATORY ANALYSES (ppm) B	T	E	X	TPH	% -200
0			CLAY, Silty, Firm, Dark Brown to Brown, Moist			0.8						
5						0.5						
10						0.9						
15			- moisture increasing below 16'			0						
20			SAND, Loose, Tan, Moist			0						
25												
30			Boring terminated at 28.0 ft.									
35												
40												

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT

DEPTH DRILLED:	28.0 ft	**DEPTH TO WATER:**	Dry	**PROJ. No.:**	ASF06-456-35
DATE DRILLED:	10/27/2016	**DATE MEASURED:**	10/27/2016		

LOG OF BORING NO. SVE-6

Closed City of Tomball Landfill - MSW Permit No. 1140A
RN102120755 / CN600667190
Harris County, Texas

RABA KISTNER
TBPE Firm Registration No. F-3257

DRILLING METHOD: Hollow Stem Auger

LOCATION: UTM NAD83 Z15, meters (N3333976, E248395)

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	FORMATION	PIEZOMETER	OVA (ppm)	LABORATORY ANALYSES (ppm) B	T	E	X	TPH	% -200
0			CLAY, Silty, Firm, Dark Brown to Brown, Moist			0.6						
5						1.0						
10						1.9						
15			- light brown to tan, with increasing moisture below 16'			1.3						
20			- with fine-grained sand below 20'									
			SAND, Loose, Tan, Moist			2.2						
25												
						0.6						
30			Boring terminated at 28.0 ft.									
35												
40												

DEPTH DRILLED: 28.0 ft
DATE DRILLED: 10/27/2016

DEPTH TO WATER: Dry
DATE MEASURED: 10/27/2016

PROJ. No.: ASF06-456-35

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT

LOG OF BORING NO. SVE-7

Closed City of Tomball Landfill - MSW Permit No. 1140A
RN102120755 / CN600667190
Harris County, Texas

RABA KISTNER
TBPE Firm Registration No. F-3257

DRILLING METHOD: Hollow Stem Auger

LOCATION: UTM NAD83 Z15, meters (N3333986, E248397)

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	FORMATION	PIEZOMETER	OVA (ppm)	LABORATORY ANALYSES (ppm) B	T	E	X	TPH	% -200
0			CLAY, Silty, Firm, Dark Brown to Brown, Moist			5.0						
5						2.1						
10			- moist to wet at 10'			1.1						
15			- light brown to tan below 16'			3.3						
20			SAND, Loose, Tan, Moist			2.3						
25						0.9						
30			Boring terminated at 32.0 ft.									
35												
40												

DEPTH DRILLED:	32.0 ft	**DEPTH TO WATER:**	Dry	**PROJ. No.:**	ASF06-456-35
DATE DRILLED:	10/26/2016	**DATE MEASURED:**	10/26/2016		

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT

LOG OF BORING NO. SVE-8

Closed City of Tomball Landfill - MSW Permit No. 1140A
RN102120755 / CN600667190
Harris County, Texas

RABA KISTNER
TBPE Firm Registration No. F-3257

DRILLING METHOD: Hollow Stem Auger

LOCATION: UTM NAD83 Z15, meters (N3333991, E248393)

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	FORMATION	PIEZOMETER	OVA (ppm)	LABORATORY ANALYSES (ppm) B	T	E	X	TPH	% -200
0			CLAY, Silty, Firm, Brown, Moist			0.5						
5						2.7						
10			- reddish-brown from 10' to 18'			2.7						
15						3.1						
20			- light brown below 18'									
			SAND, Loose, Reddish-Tan, Moist			1.5						
25												
30						0.3						
			Boring terminated at 32.0 ft.									
35												
40												

DEPTH DRILLED: 32.0 ft
DATE DRILLED: 10/26/2016

DEPTH TO WATER: Dry
DATE MEASURED: 10/26/2016

PROJ. No.: ASF06-456-35

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT

LOG OF BORING NO. SVE-9

Closed City of Tomball Landfill - MSW Permit No. 1140A
RN102120755 / CN600667190
Harris County, Texas

RABA KISTNER
TBPE Firm Registration No. F-3257

DRILLING METHOD: Hollow Stem Auger

LOCATION: UTM NAD83 Z15, meters (N3333988, E248335)

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	FORMATION	PIEZOMETER	OVA (ppm)	LABORATORY ANALYSES (ppm) B	T	E	X	TPH	% -200
0			CLAY, Silty, Firm, Dark Brown, Moist			0						
5												
			- reddish-brown from 7' to 14'			0						
10			- brown, moist to wet from 10' to 16'			0						
15			- light brown below 14'			0						
			SAND, Loose, Tan to Orangish-Tan, Moist			0						
20												
25												
			Boring terminated at 28.0 ft.									
30												
35												
40												

DEPTH DRILLED: 28.0 ft
DATE DRILLED: 10/26/2016

DEPTH TO WATER: Dry
DATE MEASURED: 10/26/2016

PROJ. No.: ASF06-456-35

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT

LOG OF BORING NO. SVE-10

Closed City of Tomball Landfill - MSW Permit No. 1140A
RN102120755 / CN600667190
Harris County, Texas

RABA KISTNER
TBPE Firm Registration No. F-3257

DRILLING METHOD: Hollow Stem Auger

LOCATION: UTM NAD83 Z15, meters (N3333986, E248328)

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	FORMATION	PIEZOMETER	OVA (ppm)	LABORATORY ANALYSES (ppm) B	T	E	X	TPH	% -200
0			CLAY, Silty, Firm, Dark Brown, Moist			0						
5			- reddish-brown from 7' to 14'			0						
10						0						
15			- light brown to tan below 14'			0						
20			SAND, Loose, Tan, Moist			0						
25			Boring terminated at 26.0 ft.									
30												
35												
40												

DEPTH DRILLED: 26.0 ft
DATE DRILLED: 10/26/2016

DEPTH TO WATER: Dry
DATE MEASURED: 10/26/2016

PROJ. No.: ASF06-456-35

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT

LOG OF BORING NO. SVE-11

Closed City of Tomball Landfill - MSW Permit No. 1140A
RN102120755 / CN600667190
Harris County, Texas

RABA KISTNER
TBPE Firm Registration No. F-3257

DRILLING METHOD: Hollow Stem Auger

LOCATION: UTM NAD83 Z15, meters (N3333983, E248321)

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	FORMATION	PIEZOMETER	OVA (ppm)	LABORATORY ANALYSES (ppm) B	T	E	X	TPH	% -200
0			CLAY, Silty, Firm, Dark Brown, Moist			0.8						
5												
			- reddish-brown from 7' to 15'			1.2						
10						3.0						
15			- light brown to tan below 15'			1.8						
			SAND, Loose, Tan to Orangish-Tan, Moist									
20						1.8						
25												
30			Boring terminated at 29.0 ft.									
35												
40												

DEPTH DRILLED: 29.0 ft
DATE DRILLED: 10/26/2016

DEPTH TO WATER: Dry
DATE MEASURED: 10/26/2016

PROJ. No.: ASF06-456-35

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT

LOG OF BORING NO. SVE-12

Closed City of Tomball Landfill - MSW Permit No. 1140A
RN102120755 / CN600667190
Harris County, Texas

RABA KISTNER
TBPE Firm Registration No. F-3257

DRILLING METHOD: Hollow Stem Auger

LOCATION: UTM NAD83 Z15, meters (N3333982, E248312)

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	FORMATION	PIEZOMETER	OVA (ppm)	LABORATORY ANALYSES (ppm) B	T	E	X	TPH	% -200
0			CLAY, Silty, Firm, Dark Brown, Moist			5.7						
5			- reddish-brown from 7' to 13'			1.7						
10						1.8						
15			- light brown below 13'			1.8						
20			SAND, Loose, Tan to Orangish-Tan, Moist			0.8						
25						0.4						
30			Boring terminated at 30.0 ft.									
35												
40												

DEPTH DRILLED: 30.0 ft
DATE DRILLED: 10/26/2016

DEPTH TO WATER: Dry
DATE MEASURED: 10/26/2016

PROJ. No.: ASF06-456-35

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT

STATE OF TEXAS WELL REPORT for Tracking #437147

Owner:	**City of Tomball**	Owner Well #:	**SVE-1**
Address:	**501 James Street Tomball, TX 77375**	Grid #:	**60-60-1**
Well Location:	**Closed City of Tomball Landfill Tomball, TX 77375**	Latitude:	**30° 06' 34.79" N**
		Longitude:	**095° 36' 34.44" W**
	0.4 Miles north of East Hufsmith Road on Rudolph Road	Elevation:	**No Data**
Well County:	**Harris**		
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **10/24/2016** Drilling End Date: **10/28/2016**

	Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
Borehole:	**10.25**	**0**	**30**

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Filter Packed**

	Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
Filter Pack Intervals:	**18**	**30**	**Pea Gravel**	**5/8" +/-**

	Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
Annular Seal Data:	**0**	**2**	**Concrete 1.615 Bags/Sacks**
	2	**18**	**Bentonite 10.16 Bags/Sacks**

Seal Method: **Hand Mixed**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Vortex Drilling Inc**

4412 Bluemel Road
San Antonio, TX 78240

Driller Name: **Robert Joiner** License Number: **54776**

Apprentice Name: **Eric Castillo**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**10**	**CLAY, Silty, Stiff, Light Brown, Moist**
10	**13**	**- brown to orangish-brown from 10' to 13'**
13	**15**	**- light brown to tan from 13' to 15'**
15	**20**	**- tan below 15'**
20	**30**	**SAND, Loose, Tan, Moist**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
4	**Turbine Ventilator 10-1/4"**	**New Galvanized Steel**			
4	**Riser**	**New Plastic (PVC)**	**40**	**-7**	**19**
4	**Screen V-Wrap**	**New Stainless Steel**	**304 / 0.25**	**19**	**29**
4	**Sump**	**New Stainless Steel**	**304**	**29**	**30**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 463-7880

STATE OF TEXAS WELL REPORT for Tracking #437152

Owner:	**City of Tomball**	Owner Well #:	**SVE-2**
Address:	**501 James Street Tomball, TX 77375**	Grid #:	**60-60-1**
Well Location:	**Closed City of Tomball Landfill Tomball, TX 77375**	Latitude:	**30° 06' 35.05" N**
		Longitude:	**095° 36' 34.19" W**
	0.4 Miles north of East Hufsmith Road on Rudolph Road	Elevation:	**No Data**
Well County:	**Harris**		
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **10/24/2016** Drilling End Date: **10/28/2016**

	Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
Borehole:	**10.25**	**0**	**33**

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
21	**33**	**Pea Gravel**	**5/8" +/-**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**2**	**Concrete 1.615 Bags/Sacks**
2	**21**	**Bentonite 12.07 Bags/Sacks**

Seal Method: **Hand Mixed**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Vortex Drilling Inc**

4412 Bluemel Road
San Antonio, TX 78240

Driller Name: **Robert Joiner** License Number: **54776**

Apprentice Name: **Eric Castillo**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**3**	**CLAY, Silty, Firm, Brown, Moist**
3	**11**	**- dark brown from 3' to 6'**
11	**17**	**- orangish-brown from 11' to 17'**
17	**21**	**- light brown to tan from 17' to 21'**
21	**21**	**- reddish-brown below 21'**
21	**33**	**SAND, Loose, Tan, Moist**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
4	**Turbine Ventilator 10-1/4"**	**New Galvanized Steel**			
4	**Riser**	**New Plastic (PVC)**	**40**	**-7**	**22**
4	**Screen V-Wrap**	**New Stainless Steel**	**304 / 0.25**	**22**	**32**
4	**Sump**	**New Stainless Steel**	**304**	**32**	**33**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 463-7880

STATE OF TEXAS WELL REPORT for Tracking #437154

Owner:	**City of Tomball**	Owner Well #:	**SVE-3**
Address:	**501 James Street Tomball, TX 77375**	Grid #:	**60-60-1**
Well Location:	**Closed City of Tomball Landfill Tomball, TX 77375**	Latitude:	**30° 06' 35.32" N**
		Longitude:	**095° 36' 34.08" W**
	0.4 Miles north of East Hufsmith Road on Rudolph Road	Elevation:	**No Data**
Well County:	**Harris**		
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **10/24/2016** Drilling End Date: **10/28/2016**

	Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
Borehole:	**10.25**	**0**	**36**

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
24	**36**	**Pea Gravel**	**5/8" +/-**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**2**	**Concrete 1.615 Bags/Sacks**
2	**24**	**Bentonite 13.98 Bags/Sacks**

Seal Method: **Hand Mixed**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **17 ft.** below land surface on **2016-10-25**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Vortex Drilling Inc**

4412 Bluemel Road
San Antonio, TX 78240

Driller Name: **Robert Joiner** License Number: **54776**

Apprentice Name: **Eric Castillo**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**7**	**CLAY, Silty, Firm, Brown, Moist**
7	**12**	**- moist to wet at 7'**
12	**14**	**- sandy, gray, wet below 12'**
14	**16**	**SAND, Clayey, Brown, Wet to Saturated**
16	**17**	**CLAY, Sandy, Brown, Wet to Saturated**
17	**22**	**- GROUNDWATER encountered at 17'**
22	**24**	**CLAY, Silty, Firm, Brown to Tan, Wet to Moist**
24	**36**	**SAND, Loose, Tan, Moist**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
4	**Turbine Ventilator 10-1/4"**	**New Galvanized Steel**			
4	**Riser**	**New Plastic (PVC)**	**40**	**-7**	**25**
4	**Screen V-Wrap**	**New Stainless Steel**	**304 / 0.25**	**25**	**35**
4	**Sump**	**New Stainless Steel**	**304**	**35**	**36**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 463-7880

STATE OF TEXAS WELL REPORT for Tracking #437155

Owner:	**City of Tomball**	Owner Well #:	**SVE-4**
Address:	**501 James Street Tomball, TX 77375**	Grid #:	**60-60-1**
Well Location:	**Closed City of Tomball Landfill Tomball, TX 77375**	Latitude:	**30° 06' 35.58" N**
		Longitude:	**095° 36' 34.05" W**
	0.4 Miles north of East Hufsmith Road on Rudolph Road	Elevation:	**No Data**
Well County:	**Harris**		
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **10/24/2016** Drilling End Date: **10/28/2016**

	Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
Borehole:	**10.25**	**0**	**33**

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
21	**33**	**Pea Gravel**	**5/8" +/-**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**2**	**Concrete 1.615 Bags/Sacks**
2	**21**	**Bentonite 12.07 Bags/Sacks**

Seal Method: **Hand Mixed**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Vortex Drilling Inc**

4412 Bluemel Road
San Antonio, TX 78240

Driller Name: **Robert Joiner** License Number: **54776**

Apprentice Name: **Eric Castillo**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**10**	**CLAY, Silty, Firm, Brown, Moist**
10	**18**	**- reddish-brown from 10' to 18'**
18	**21**	**- light brown below 18'**
21	**33**	**SAND, Loose, Tan, Moist**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
4	**Turbine Ventilator 10-1/4"**	**New Galvanized Steel**			
4	**Riser**	**New Plastic (PVC)**	**40**	**-7**	**22**
4	**Screen V-Wrap**	**New Stainless Steel**	**304 / 0.25**	**22**	**32**
4	**Sump**	**New Stainless Steel**	**304**	**32**	**33**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 463-7880

STATE OF TEXAS WELL REPORT for Tracking #437156

Owner:	**City of Tomball**	Owner Well #:	**SVE-5**
Address:	**501 James Street Tomball, TX 77375**	Grid #:	**60-60-1**
Well Location:	**Closed City of Tomball Landfill Tomball, TX 77375**	Latitude:	**30° 06' 39.77" N**
		Longitude:	**095° 36' 40.29" W**
	0.4 Miles north of East Hufsmith Road on Rudolph Road	Elevation:	**No Data**
Well County:	**Harris**		
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **10/24/2016** Drilling End Date: **10/28/2016**

	Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
Borehole:	**10.25**	**0**	**28**

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
16	**28**	**Pea Gravel**	**5/8" +/-**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**2**	**Concrete 1.615 Bags/Sacks**
2	**16**	**Bentonite 8.89 Bags/Sacks**

Seal Method: **Hand Mixed**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Vortex Drilling Inc**

4412 Bluemel Road
San Antonio, TX 78240

Driller Name: **Robert Joiner** License Number: **54776**

Apprentice Name: **Eric Castillo**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**16**	**CLAY, Silty, Firm, Dark Brown to Brown, Moist**
16	**21**	**- moisture increasing below 16'**
21	**28**	**SAND, Loose, Tan, Moist**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
4	**Turbine Ventilator 10-1/4"**	**New Galvanized Steel**			
4	**Riser**	**New Plastic (PVC)**	**40**	**-7**	**17**
4	**Screen V-Wrap**	**New Stainless Steel**	**304 / 0.25**	**17**	**27**
4	**Sump**	**New Stainless Steel**	**304**	**27**	**28**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 463-7880

STATE OF TEXAS WELL REPORT for Tracking #437157

Owner:	**City of Tomball**	Owner Well #:	**SVE-6**
Address:	**501 James Street Tomball, TX 77375**	Grid #:	**60-60-1**
Well Location:	**Closed City of Tomball Landfill Tomball, TX 77375**	Latitude:	**30° 06' 40.03" N**
		Longitude:	**095° 36' 40.26" W**
	0.4 Miles north of East Hufsmith Road on Rudolph Road	Elevation:	**No Data**
Well County:	**Harris**		
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **10/24/2016** Drilling End Date: **10/28/2016**

	Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
Borehole:	**10.25**	**0**	**28**

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
16	**28**	**Pea Gravel**	**5/8" +/-**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**2**	**Concrete 1.615 Bags/Sacks**
2	**16**	**Bentonite 8.89 Bags/Sacks**

Seal Method: **Hand Mixed**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Vortex Drilling Inc**

4412 Bluemel Road
San Antonio, TX 78240

Driller Name: **Robert Joiner** License Number: **54776**

Apprentice Name: **Eric Castillo**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**16**	**CLAY, Silty, Firm, Dark Brown to Brown, Moist**
16	**20**	**- light brown to tan, with increasing moisture below 16'**
20	**20**	**- with fine-grained sand below 20'**
20	**28**	**SAND, Loose, Tan, Moist**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
4	**Turbine Ventilator 10-1/4"**	**New Galvanized Steel**			
4	**Riser**	**New Plastic (PVC)**	**40**	**-7**	**17**
4	**Screen V-Wrap**	**New Stainless Steel**	**304 / 0.25**	**17**	**27**
4	**Sump**	**New Stainless Steel**	**304**	**27**	**28**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 463-7880

STATE OF TEXAS WELL REPORT for Tracking #437160

Owner:	**City of Tomball**	Owner Well #:	**SVE-7**
Address:	**501 James Street Tomball, TX 77375**	Grid #:	**60-60-1**
Well Location:	**Closed City of Tomball Landfill Tomball, TX 77375**	Latitude:	**30° 06' 40.36" N**
		Longitude:	**095° 36' 40.19" W**
	0.4 Miles north of East Hufsmith Road on Rudolph Road	Elevation:	**No Data**
Well County:	**Harris**		
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **10/24/2016** Drilling End Date: **10/28/2016**

	Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
Borehole:	**10.25**	**0**	**32**

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
20	**32**	**Pea Gravel**	**5/8" +/-**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**2**	**Concrete 1.615 Bags/Sacks**
2	**20**	**Bentonite 11.43 Bags/Sacks**

Seal Method: **Hand Mixed**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Vortex Drilling Inc**

4412 Bluemel Road
San Antonio, TX 78240

Driller Name: **Robert Joiner** License Number: **54776**

Apprentice Name: **Eric Castillo**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**10**	**CLAY, Silty, Firm, Dark Brown to Brown, Moist**
10	**16**	**- moist to wet at 10**
16	**21**	**- light brown to tan below 16'**
21	**32**	**SAND, Loose, Tan, Moist**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
4	**Turbine Ventilator 10-1/4"**	**New Galvanized Steel**			
4	**Riser**	**New Plastic (PVC)**	**40**	**-7**	**21**
4	**Screen V-Wrap**	**New Stainless Steel**	**304 / 0.25**	**21**	**31**
4	**Sump**	**New Stainless Steel**	**304**	**31**	**32**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 463-7880

ATTACHMENT B

LANDFILL GAS MONITORING FIELD DATA FORM

LANDFILL GAS MEASUREMENTS
City of Tomball Landfill - MSW Permit No. 1140A
Tomball, Harris County, Texas

Date:

	Methane		H_2S (ppm)	O_2 (ppm)	CO_2 (ppm)	Time	Comments (odor, moisture, etc.)
	% LEL	% by volume					
LANDFILL GAS DETECTION PROBE No.							
LGDP-1							
LGDP-2							
LGDP-3							
LGDP-4							
LGDP-5							
LGDP-6							
LGDP-7							
AMBIENT AIR MONITORING STATION No. (If Applicable)							
AS-1							
AS-2							
AS-3							
AS-4							
AS-5							
AS-6							
AS-7							
AS-8							
AS-9							
AS-10							
AS-11							
AS-12							
AS-13							
LANDFILL GAS VENT No.							
MV-1							
MV-2							
MV-3							
MV-4							
MV-5							
MV-6							
MV-7							
MV-8							
MV-9							

LANDFILL GAS MEASUREMENTS
City of Tomball Landfill - MSW Permit No. 1140A
Tomball, Harris County, Texas

Date:

	Methane		H_2S (ppm)	O_2 (ppm)	CO_2 (ppm)	Time	Comments (odor, moisture, etc.)
	% LEL	% by volume					
LANDFILL GAS VENT No.							
MV-10							
MV-11							
MV-12							
MV-13							
MV-14							
MV-15							
MV-16							
MV-17							
MV-18							
MV-19							
MV-20							
MV-21							
MV-22							
MV-23							
MV-24							
MV-25							
MV-26							
MV-27							
MV-28							
MV-29							
MV-30							
MV-31							
MV-32							
MV-33							
MV-34							
MV-35							
MV-36							
MV-37							
MV-38							
MV-39							
MV-40							

LANDFILL GAS MEASUREMENTS
City of Tomball Landfill - MSW Permit No. 1140A
Tomball, Harris County, Texas

Date:

	Methane		H_2S (ppm)	O_2 (ppm)	CO_2 (ppm)	Time	Comments (odor, moisture, etc.)
	% LEL	% by volume					
LANDFILL GAS VENT No.							
MV-41							
MV-42							
MV-43							
SOIL VAPOR EXTRACTION VENT No.							
SVE-1							
SVE-2							
SVE-3							
SVE-4							
SVE-5							
SVE-6							
SVE-7							
GROUNDWATER MONITORING WELL No.							
MW-1							
MW-2							
MW-2A							
MW-3							
MW-4							
MW-4A							
MW-5							
MW-6							
MW-7							
MW-9							
MW-10							
MW-11							
MW-12							
MW-13							
MW-14							
MW-15							
MW-16							